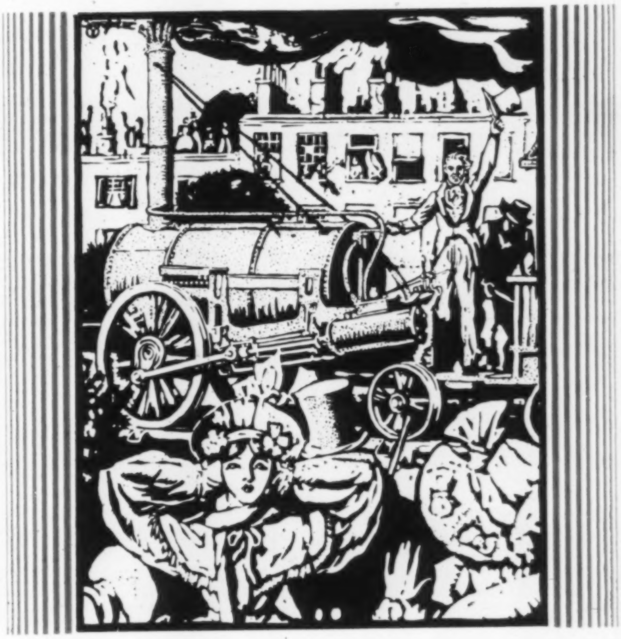
OCT 16 1934

OCTOBER 1934

MACHINE DESIGN

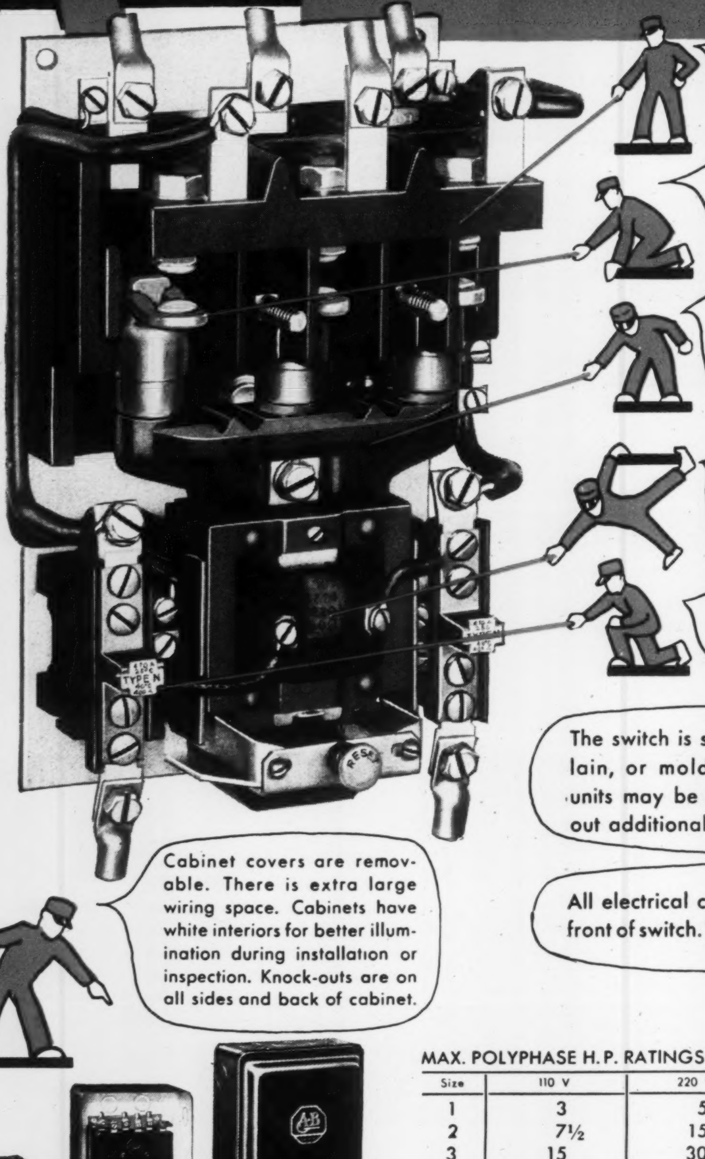


AS IT AFFECTS

ENGINEERING—PRODUCTION—SALES

Look! An Upheaval in Starter Design!

50 and 100 Ampere Solenoid Starters now added to Bulletin 709 Line



View of Size 2 Starter, removed from cabinet. Arc hood is open to show contacts and arc chambers.

This patented arc hood steps up switching capacity tremendously. Ten times maximum rated current at listed voltage easily disrupted.

Double-break contact design eliminates flexible leads. No insulating oxides can form on the silver alloy contacts. There is no contact maintenance.

Vertical switching action prevents accidental closure from jars or jolts. No bearings to stick. Pick-up and drop-out voltages are astoundingly low:—pick-up 70%; drop-out, 50% of line voltage.

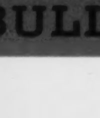
This solenoid-operated switch occupies much less space than clapper switches. It is the smallest starter on the market for its ratings. Ideal for group mounting.

Two soldered-type relays, reset from front of cabinet, afford accurate and dependable overload protection.

The switch is self-insulated—no slate, porcelain, or molded panels are used. Switch units may be bolted on metal surfaces without additional insulation.

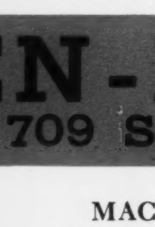
All electrical connections are accessible from front of switch. There is no back-of-panel wiring.

Cabinet covers are removable. There is extra large wiring space. Cabinets have white interiors for better illumination during installation or inspection. Knock-outs are on all sides and back of cabinet.



Size 1
25 Amp.

Size 2
50 Amp.



Size 3
100 Amp.

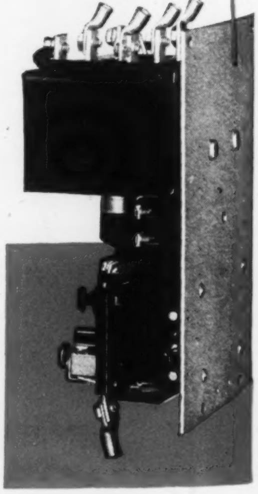
Bulletin 709 Solenoid Automatic Starter

MAX. POLYPHASE H.P. RATINGS OF BULLETIN 709 LINE

Size	110 V	220 V.	440-550 V.
1	3	5	7½
2	7½	15	25
3	15	30	50

With the larger ratings now available in the sizes 1, 2, and 3 Bulletin 709 starters, the majority of across-the-line switch applications can now enjoy the advantages inherent in the solenoid starter. Before you buy new automatic starters, make a thorough investigation of the enlarged Bulletin 709 Solenoid Line. Send for Bulletin and Price Sheet.

ALLEN-BRADLEY CO., 1333 S. First St., Milwaukee, Wis.



ALLEN-BRADLEY
BULLETIN 709 SOLENOID STARTERS

MACHINE DESIGN

EDITOR
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ASSOCIATE EDITORS
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F. H. BURGESS

VOLUME VI OCTOBER, 1934 NUMBER 10

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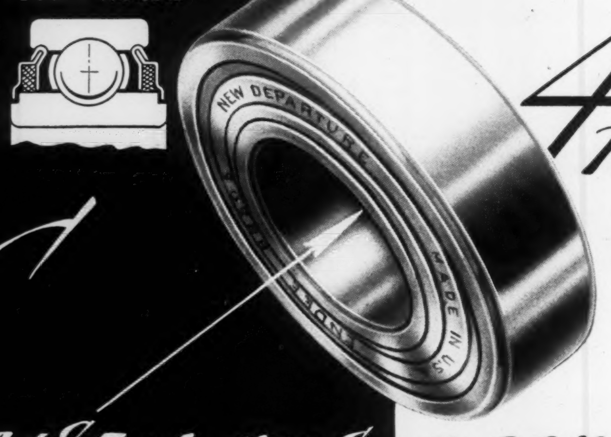
Penton Building Cleveland, O.
Affiliated with The Penton Publishing Co.

Branch Offices: New York, 220 Broadway; telephone Cortland 7-4594. Chicago, 1118 Peoples Gas Bldg.; telephone, Harrison 7506. London, The Penton Publishing Co. Ltd., 416 Caxton House, Westminster, S. W. 1.

Machine Design is published on the tenth of each month. Subscription rates: United States and possessions, Cuba and Mexico, two years $5; one year $3. Single copies, 35 cents. Canada, one year $4.80, including duty. Great Britain and other European countries, two years, £1.13.6; one year £1.0.0. Copyright, 1934 by The Johnson Publishing Co., Cleveland, O. Acceptance under the Act of June 5, 1934, authorized July 20, 1934.

DOUBLE N-D-SEAL



4 new bearings LUBRICATED FOR LIFE

Every one a sensational hit!

Double N-D-Seal, a totally enclosed bearing, solves the designer's problem of bearing mountings where relubrication is either difficult or impossible. Since lubricant is effectively and permanently enclosed and no dirt can enter the bearing, any wear from this cause is positively eliminated. Under the moderate speeds for which it is intended, maintenance is reduced to zero.

Mine Car Wheel Bearing, completely eliminates lubrication expense and keeps out dirt, water and other foreign materials. By removing three nuts a worn wheel can be taken off and a new one slipped on, without a chance of dirt getting into the bearing. Preloaded and non-adjustable.

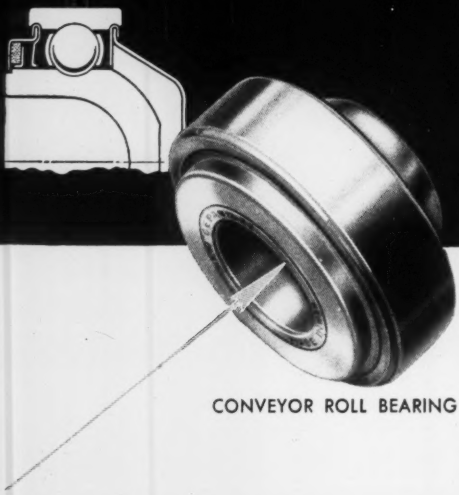
Conveyor Roll Bearing, marks the beginning of a new era in conveyor design. It is permanently sealed and lubricated for life. Eliminates all separate closure parts. Positively dust proof and service free. Think of the advantage of miles of conveyors without need of an oil can or a grease gun!

Automobile Rear Wheel Bearing, first used on Oldsmobile Six. No more leaking grease or slipping brakes, no locknuts, thread or grooves on shaft, no grease cups or gun fittings. Forever proof against maladjustment or neglect.

NEW DEPARTURE
MADE IN USA

MINE CAR WHEEL BEARING

These new bearings are proof of New Departure leadership in bearing design and practice. Before you buy another bearing see what New Departure has to offer. The New Departure Manufacturing Company, Bristol, Connecticut; Detroit, Chicago and San Francisco.



CONVEYOR ROLL BEARING

REAR WHEEL BEARING

NEW DEPARTURE

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Classified for Convenience when
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Key: Edit., Editorial Pages; Adv., Advertising Pages; R, Right hand column; L. Left hand column

NEW

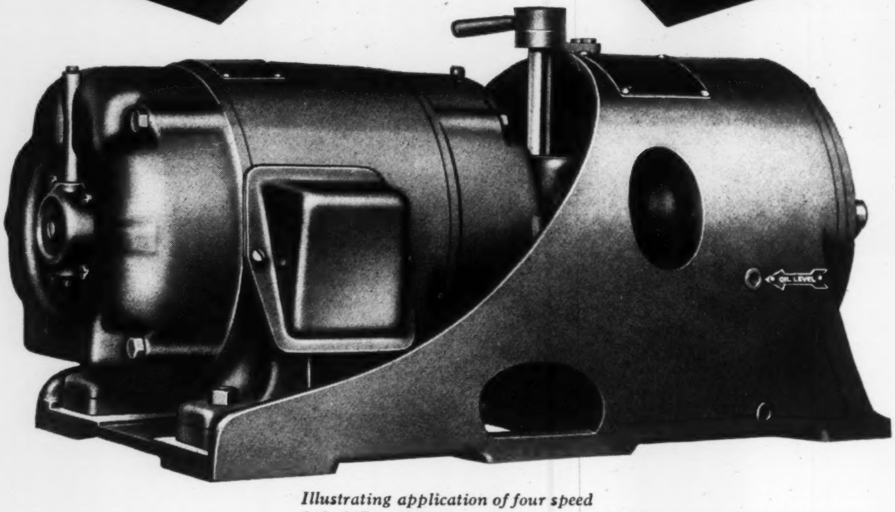
Century

GEAR MOTORS

8 SPEEDS

4 Speed
MOTOR

2 Speed
GEAR



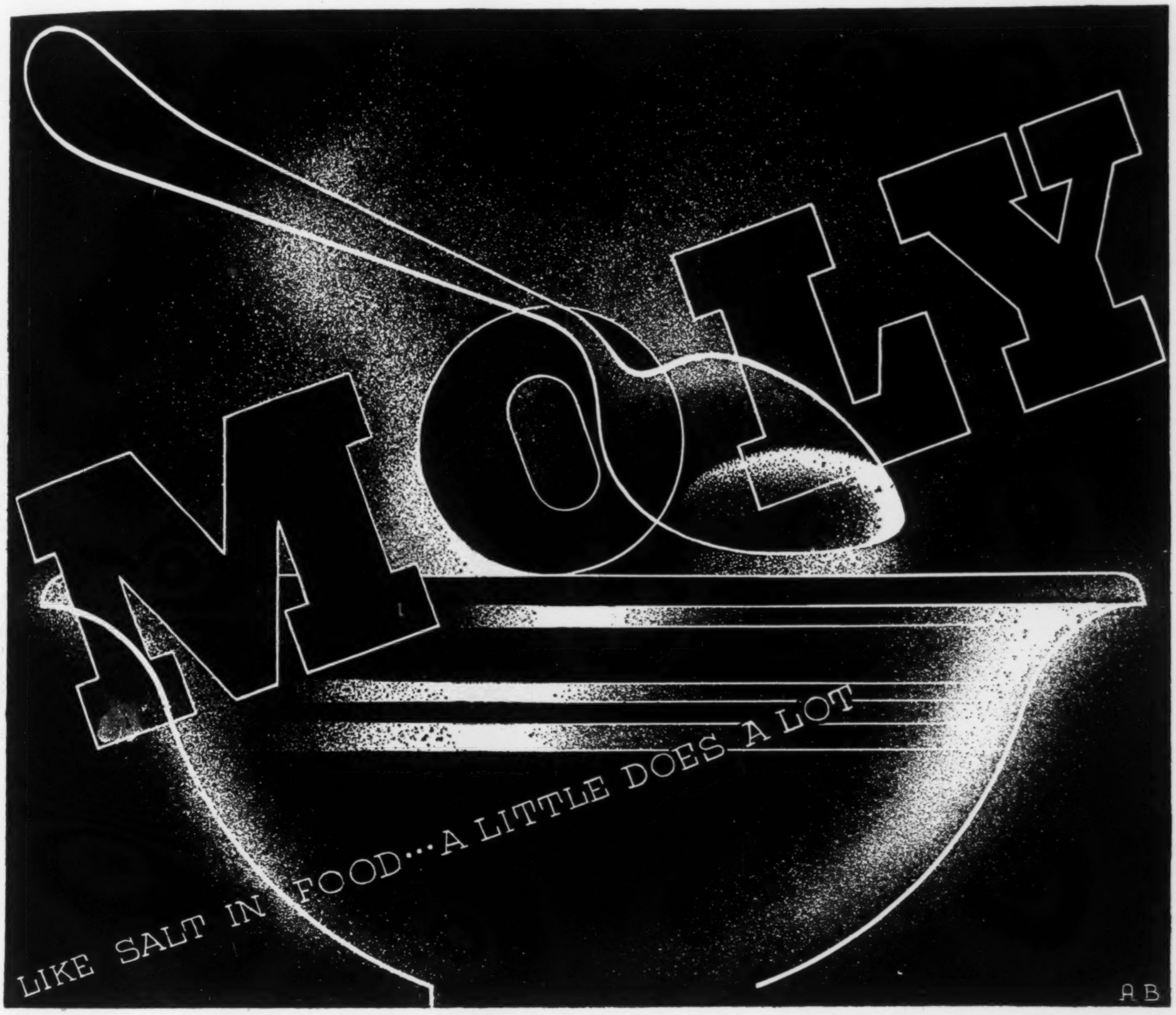
Illustrating application of four speed Splash Proof Motor to two speed gear.

COMPLETE MOTOR TYPE • • QUICK MOUNTING

Write for Data on Century Gear Motors

CENTURY ELECTRIC COMPANY
1806 Pine Street • • St. Louis, Mo.
Offices and Stock Points in Principal Cities

SINGLE PHASE • POLYPHASE • DIRECT CURRENT • 1/250 to 600 H. P.


MOLY
LIKE SALT IN FOOD ... A LITTLE DOES A LOT
A B

AN INTERESTING example of what a lot of work a small amount of Molybdenum can do may be found in the following comparison of two steels:

	No. 1	No. 2
C	.28/.37%	.23/.30%
Mn	.30/.70	.30/.70
Cr	.65/1.35	.75/1.00
Ni	3.00/3.50	2.55/3.05
Mo	nil	.30/.50
Elastic Limit	116,700 p. s. i.	130,000 p. s. i.
Ult. Tens. Strength	135,200 p. s. i.	142,000 p. s. i.
Elong. % in 2"	19.6	20.5
Red. of Area %	57.1	65.0

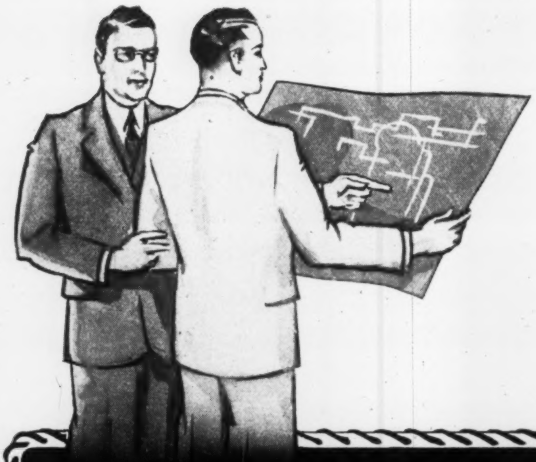
Thus it will be seen that the addition of *less than one-half of one per cent* Molybdenum, with lower Nickel and Chrome, produced an increase of 13,000 lbs. in Elastic Limit and 7000 lbs. in Ultimate Strength. At the same time, Elongation was raised 1% and Reduction of Area 8%.

This is just one of various directions in which "*Moly Improves Steel and Iron*" (which is the title of a book we have recently printed for the benefit of executives and engineers). The cost of the small amount of "Moly" required is in distinctly profitable relation to the results achieved.

Our new house-organ, "*The Moly Matrix,*" enables you to keep up to date in the progress of Molybdenum. Ask to be put on our mailing-list. Write also for these interesting new books: "*Molybdenum in 1934*" and "*Molybdenum in Cast Iron — 1934 Supplement.*" If you have an alloy problem, let our metallurgists and modern experimental laboratory in Detroit help you. Climax Molybdenum Company, 295 Madison Avenue, New York.

Visit our booth, No. 108, at the International Foundry Congress, Phila., October 22-26

CLIMAX Mo-lyb-den-um



1+1=2

SIMPLE ARITHMETIC

Yet Vital to Spring Performance

IN THE development of new equipment—efficient spring performance is not alone a matter of perfectly designed machines—or perfectly designed springs. Instead—it is a combination of both factors—of cooperation between the maker of springs and the manufacturer using them—that assures unfailing performance. In other words—1+1=2—the most valuable of all formulae when special or unusual installations are called for. If you are planning a new device—or if present spring applications are proving troublesome—we suggest that you get in touch with us. Interesting and detailed information is available.

American QUALITY Steel & Wire Company SPRINGS

1831 MORE THAN 100 YEARS OF PROGRESS IN WIRE MAKING 1934

AMERICAN STEEL & WIRE COMPANY

208 South La Salle Street, Chicago
94 Grove Street, Worcester

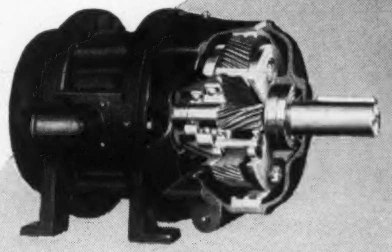
SUBSIDIARY OF UNITED STATES STEEL CORPORATION
AND ALL PRINCIPAL CITIES

Empire State Building, New York
First National Bank Building, Baltimore

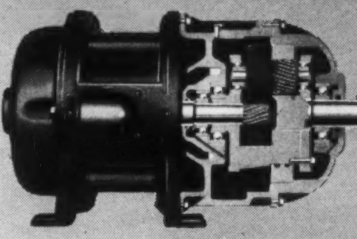
Pacific Coast Distributors: Columbia Steel Company, Russ Bldg., San Francisco
Export Distributors: United States Steel Products Company, New York

SOUND in every detail of design and manufacture

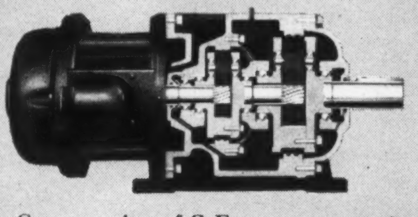
G-E gear-motors provide long life and reliable performance



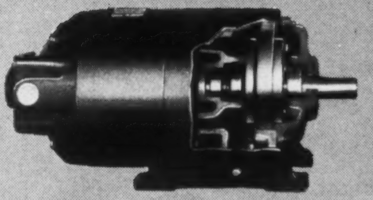
Cutaway view of G-E gear-motor, typical of 100-series gears in single-reduction units: output-shaft speeds, 600 to 154 rpm.



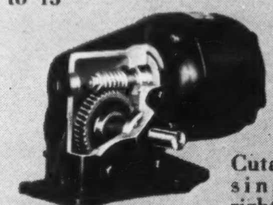
Cutaway view of G-E gear-motor, typical of 200-series gears in compound-reduction units; output-shaft speeds, 145 to 71 rpm.



Cutaway view of G-E gear-motor, typical of 300-series gears in double-reduction units; output-shaft speeds, 63.5 to 13 rpm.



Cutaway view of single-planetary, concentric-shaft, fractional-horsepower G-E gear-motor; 500 to 98 rpm



Cutaway view of single-worm, right-angle-shaft. G-E fractional-horsepower gear-motor; 197 to 11 rpm.

STANDARD RATINGS

600 to 11 Rpm.
Polyphase, 1/6 to 75 hp.
Single-phase, 1/6 to 5 hp.
Direct-current, 1/6 to 7 1/2 hp.

Other speeds and horsepower ratings can be furnished on request. Mechanical modifications, such as flange mounting, vertical motors, etc., are available.

Speed adjustment can be obtained by selecting a motor with the requisite electrical characteristics.

YEARS of experience in the manufacture and application of gear reducers have established certain engineering principles which are the best assurance of a sound product and a long life of successful performance.

It is upon these principles that G-E gear-motors are designed, manufactured, and applied.

G-E gear-motors—a combination of motor with helical-planetary-type reduction gears—are available in a wide range of sizes and in a number of electrical and mechanical modifications to meet properly your requirements for low-speed drives.

G-E gear-motors provide full-horsepower output at the low-speed shaft. Their inherent characteristics—compactness, efficiency, ease of mounting, simplicity—make them the preferred electric drive wherever low speed is desired.

020-66

GENERAL ELECTRIC

CALENDAR OF MEETINGS AND EXPOSITIONS

Oct. 13-24—

American Society of Mechanical Engineers.

Wood Industries division to hold annual meeting at Hotel Walt Whitman, Camden, N. J. Calvin W. Rice, 29 West Thirty-ninth street, New York, is secretary of the society.

Oct. 24-26—

American Institute of Steel Construction.

Twelfth annual meeting to be held at Edgewater Beach hotel, Chicago. V. G. Iden, 200 Madison avenue, New York, is acting secretary of the institute.

Oct. 15-20—

Dairy and Ice Cream Machinery and Supplies association.

Exhibition of equipment and annual meeting to be held at Public Auditorium, Cleveland. C. E. Breece, 232 Madison avenue, New York, is secretary of the association.

Oct. 17-20—

National Electrical Manufacturers association.

Annual meeting to be held at the Palmer House, Chicago. W. J. Donald, 570 Lexington avenue, New York, is managing director.

Oct. 22-23—

American Gear Manufacturers association.

Semiannual meeting to be held at The New Pfister, Milwaukee. J. C. McQuiston, Penn Lincoln hotel, Wilkinsburg, Pa., is manager-secretary.

Oct. 22-26—

American Foundrymen's association.

Annual meeting, exposition and International Foundry congress to be held at the Auditorium, Philadelphia, will include technical papers on "Porosity in Leaded Bronze Bushings," by A. W. Lorenz; "Steel Castings," by Dr. W. H. Hatfield; "Breaking Strength and Physical Properties of Gray Iron," by J. Novarro-Alacer; "Heat Treatment of Cast Iron Cylinder Liners," by W. P. Eddy Jr.; "Bronze Foundry Alloys," by O. W. Ellis; "Yellow Brass Casting Alloys," by L. Ward; and "Aluminum and Its Alloys," by H. J. Rowe as part of the program on nonferrous, steel, gray iron and malleable iron castings. C. E. Hoyt, 222 West Adams street, Chicago, is secretary of the association.

Oct. 29-Nov. 2—

American Gas association

Exposition and annual meeting to be held at the Auditorium, Atlantic City, N. J. K. R. Boyes, 420 Lexington avenue, New York, is secretary of the association.

Nov. 5-9—

Automotive Service Industries Show.

Annual exhibition of machinery and parts to be held at Cleveland Public Auditorium, Cleveland, sponsored by National Standard Parts association, Motor and Equipment Manufacturers' association and Equipment Wholesalers' association. Orville B. Gault, 1304 Eaton Tower, Detroit, is secretary of the Parts association.

Nov. 12-16—

American Bottlers of Carbonated Beverages.

Annual meeting and exposition of bottling machinery to be held in 106th Armory, Buffalo, N. Y. Offices of the organization are located at 726 Bond building, Washington.

Nov. 14-16—

International Acetylene association.

Annual meeting to be held at William Penn hotel, Pittsburgh. H. F. Reinhard, 30 East Forty-second street, New York, is secretary of the association.

Nov. 15-17—

American Institute of Chemical Engineers.

Fall meeting to be held at Pittsburgh. F. P. LeMaistre, 809 Bellevue Court building, Philadelphia, is secretary of the institute.

Dec. 3-7—

American Society of Mechanical Engineers.

Annual meeting to be held at the Engineering Societies building, New York. Calvin W. Rice, 29 West Thirty-ninth street, New York, is secretary.

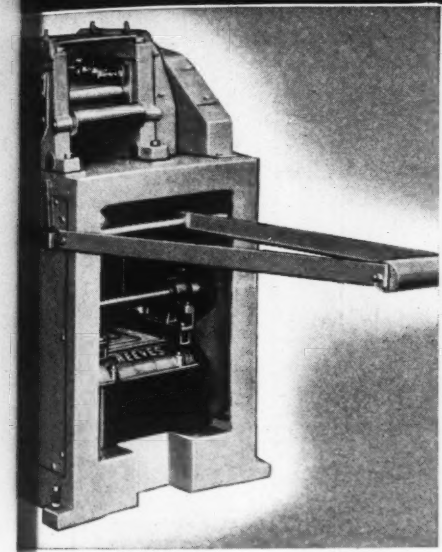
Dec. 3-8—

National Exposition of Power and Mechanical Engineering.

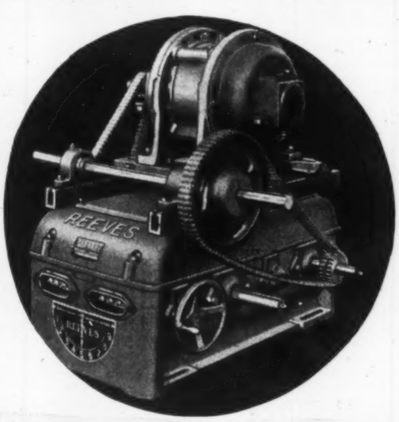
Eleventh annual exposition to be held at Grand Central Palace, New York. Information may be obtained from Charles F. Roth, Grand Central Palace, New York.

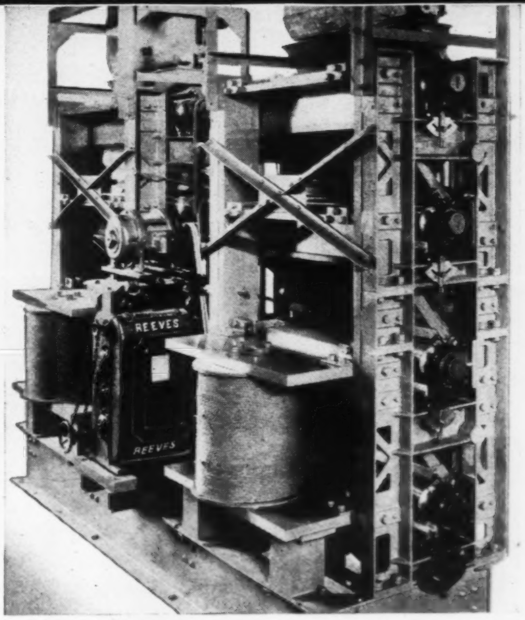
COMPLETE LINE of speed control units essential to meet ALL machine design needs »

REEVES Variable Speed Transmissions are available in a Complete Line—a Wide Range of Sizes, Proved Designs and Controls—Insuring a Correct Unit for Every Requirement.



THIS shows how compactly the horizontal enclosed REEVES Variable Speed Transmission is incorporated into base of a machine. Transmission is equipped with adjustable motor base and constant speed motor; also with countershaft unit for additional reduction in speeds. Machine is Roll Feed Straightener used with Punch Press for rapid production of flat blanks from *coiled* metal stock.

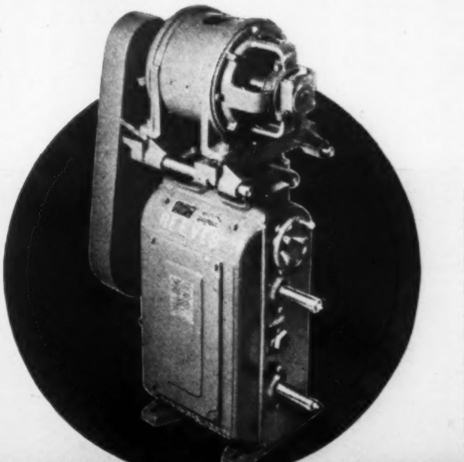


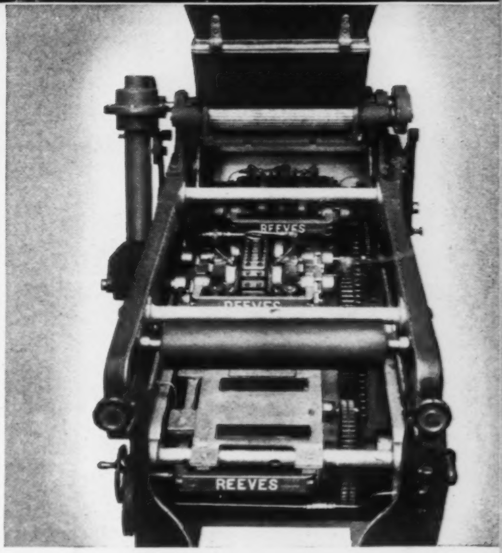


THE vertical enclosed REEVES Transmission is used primarily for installations where floor space is limited. Pictured here is application with adjustable motor base and motor, to an Induction Magnetic Separator. Operating mechanism of Transmission is thoroughly protected, yet all parts are readily accessible. "Centralized" force-feed lubrication system. The REEVES regulates speed of rotors on this Separator. These rotors separate material of higher magnetic susceptibility from non-magnetic or feebly magnetic in manufacture of artificial abrasives.

★ ★

The REEVES Variable Speed Transmission is industry's proved unit for providing any driven machine with infinite, accurate speed adjustability. Power delivery is positive at any speed, due to time-tested REEVES V-belt. Speed settings are held without fluctuation under varying loads, due to patented automatic belt tension control.





THE horizontal open REEVES is popular because of its adaptability. Mounts compactly in any position. As with all REEVES units, power take off or input may be from opposite sides or same side. In cake machine shown above (top and side covers removed), three of these units are incorporated into frame of machine proper. One controls entire machine, one controls cake sizes, one controls cakes per pan.

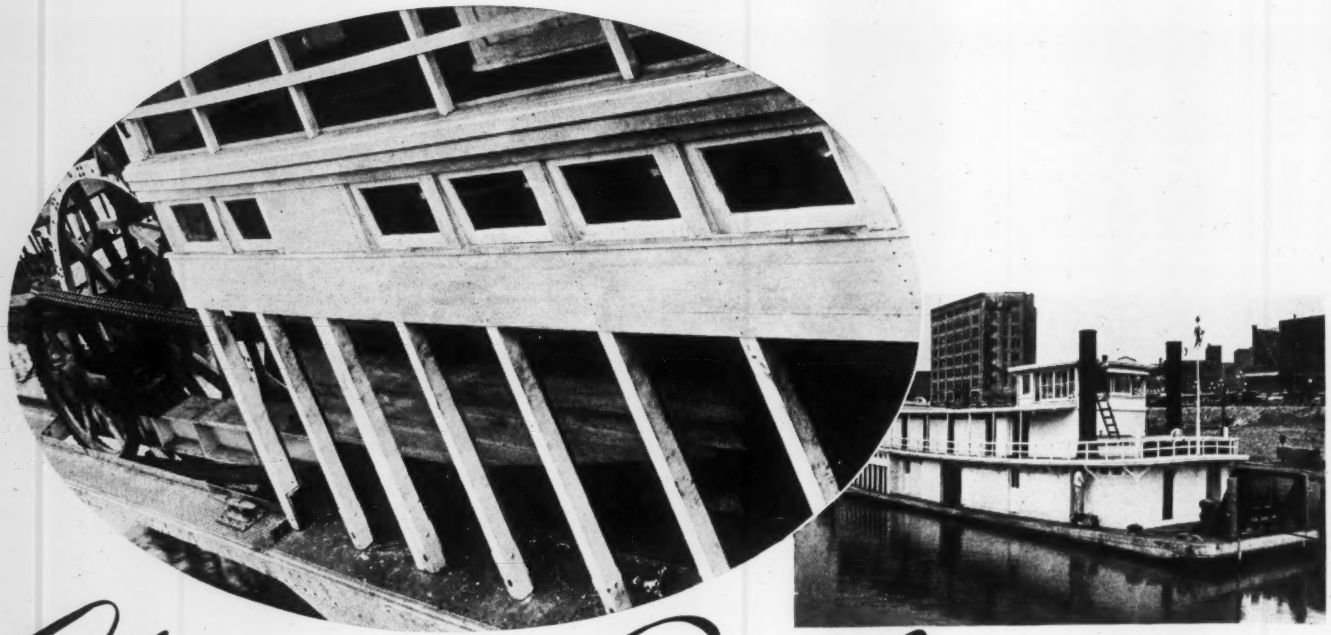
REEVES engineers have helped design infinite, sensitive speed control as standard equipment on 900 different makes of machines. Over 80,000 REEVES units now in service. Draw on this wide and seasoned experience to insure the *correct* application of speed control to your machines.

REEVES PULLEY COMPANY,
COLUMBUS, INDIANA

Send copy of latest catalog H-99 and special information on applying speed control as standard equipment on . . .

____

*Name*______________________________
*Company*______________________________
*Address*______________________________



Unique Application

PROVES COMPLETE SUCCESS

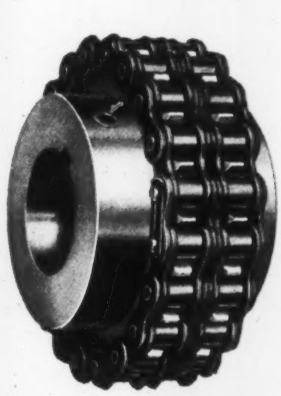
Two important facts brought out by this Baldwin-Duckworth Double Chain installation.

This use indicates the ease with which a difficult designing problem can often be satisfactorily handled by the use of roller chain. In this instance motive power has to be transmitted a fairly long distance and the drive must be positive *under all conditions,* for stoppage or failure at a crucial time might mean disaster—even the loss of the boat. Also successful cargo transportation requires low freight rates—low overhead—low operating cost. Baldwin-Duckworth Double Roller Chain furnishes the necessary strength and flexibility plus moderate first cost.

A second important thing about this installation is the successful way the chain functions under adverse conditions. The drive is fully exposed to the elements, yet this chain has withstood the rusting and abrasive action perfectly and has given thoroughly satisfactory service.

This drive is an interesting example of how successfully roller chain solves unusual power transmission requirements. Baldwin-Duckworth engineers will be glad to help you make the most advantageous use of it, for conveying, elevating or power transmission.

BALDWIN-DUCKWORTH CHAIN CORPORATION
365 Plainfield Street, Springfield, Mass.



BALDWIN - DUCKWORTH

Flexible Coupling

One length of double width Roller Chain and two cut-tooth sprockets make possible this simple but rugged coupling.

It absorbs shock loads, dampness, vibration and reduces pressure on bearings. Ask for full details.

BALDWIN DUCKWORTH

Factories at Springfield and Worcester, Mass.

MACHINE DESIGN
THE JOHNSON PUBLISHING CO., CLEVELAND, OHIO
October, 1934 Vol. 6—No. 10

Obtaining Quietness, Compactness in Room Unit

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IN MAKING a balanced design for a modern air conditioning unit, it was realized that compactness, quietness and long life were the major considerations necessary for production of an efficient apparatus. Because this type of unit has no use as a seat or for storage, the smaller its size the better. It should be quiet because the noise level in an office, home or hotel room is usually very low. Also, its life should be comparable to that of the electric refrigerator. Therefore, care had to be exercised in selecting the materials used, particularly those subjected to the corrosive action of the moisture taken from the air, and those used for the wearing parts of the compressor. Further, it was decided for reasons of economy to adopt standard parts from other compressors to this portable, self-contained unit.

With the highest cooling capacity for its size of any similar unit previously built by the company, the air conditioner described in this article has a capacity of 7000 B.T.U. per hour and is intended to cool and reduce the humidity of the air of a hotel room, a small office, or a room in the home. Almost any room having from 200 to 350 square feet of floor area and the ordinary amount of building insulation may be kept at a temperature of from seven to ten degrees below outdoor shade temperature. The unit, shown in *Fig.* 1, employs a mechanical refrigeration system with a water-cooled condenser. The working parts of the machine were designed as a single unit to be placed inside of and separate from the cabinet. The use of a separate cabinet serves two purposes. From

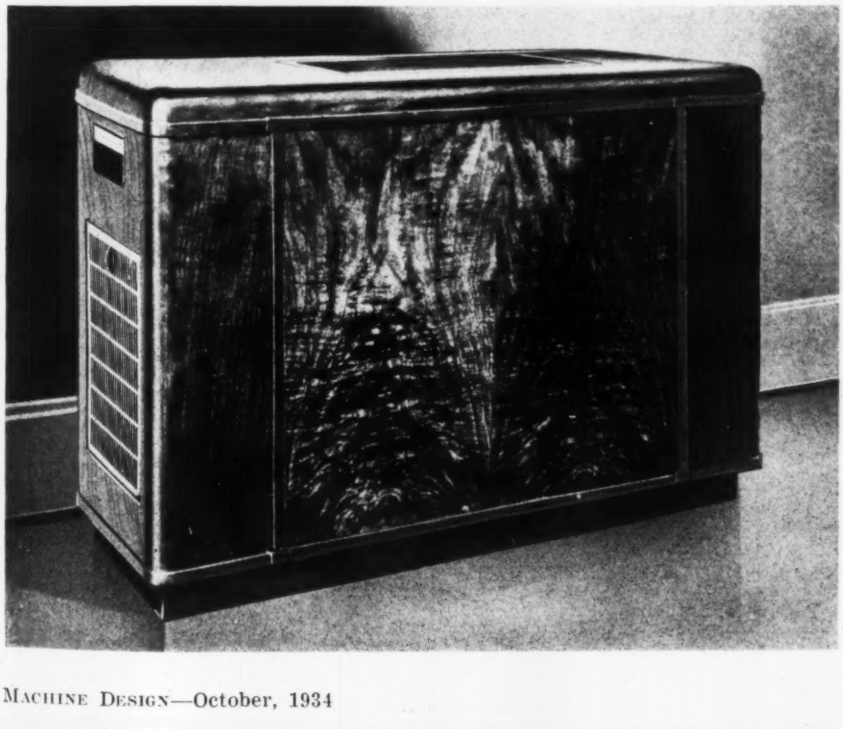

Fig. 1—Appearance was one of the major considerations in the design of a portable air conditioning unit for use in homes, offices or hotel rooms

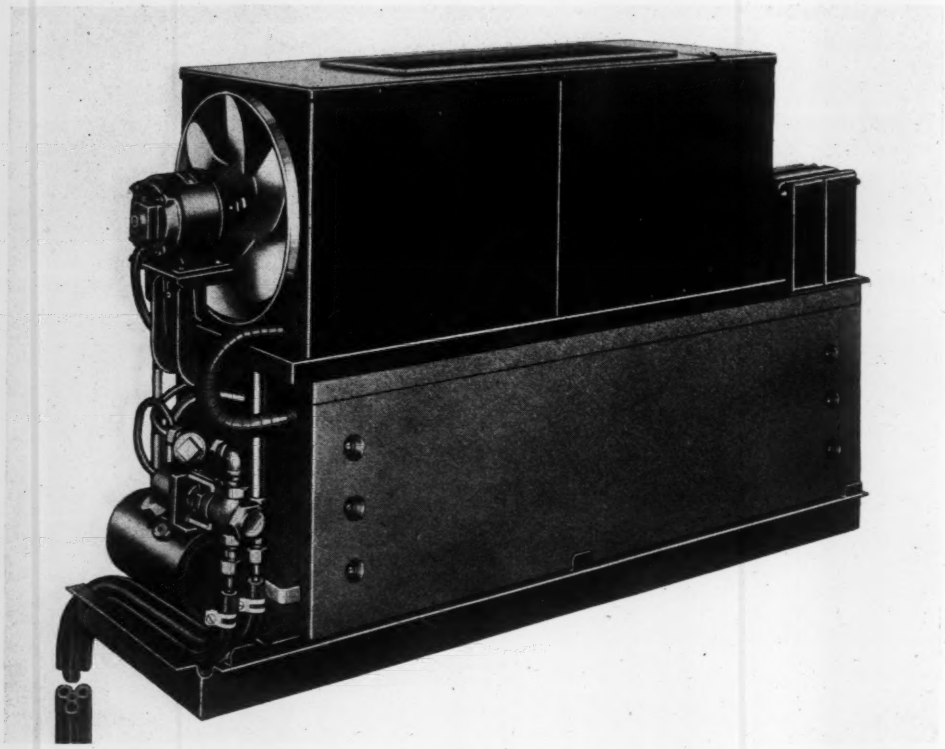

Fig. 2—The working parts of the machine are designed as a single unit to be placed inside of and separate from the cabinet, providing insulating air space

an artistic standpoint, this construction makes it easy to carry out a decorative design. It also allows the engineer to make use of an insulating air space between the cold unit and the warm cabinet to prevent the condensation of moisture from the room air on the outside of the cabinet. *Fig.* 2 shows the complete unit on the cabinet sub-base just before the cabinet is lowered over it. *Fig.* 3 is a view of the unit before it is placed into the sub base. Here the celotex heat and sound insulation is removed from one end and the front of the lower compartment to allow a view of the condensing unit.

Relay Is Part of Unit

In operation, the fan blows the air into the enclosed cooling compartment, through the slanted evaporator coil, and out the opening on top, as shown in the cutaway, isometric drawing *Fig.* 4. On the end of the upper compartment opposite from the fan are located the capacitors for the compressor motors and the fan motor, and the relay for sequentially starting the two compressor motors. The switch box carrying the toggle switches for manually starting the fan and the compressor is part of the inside unit; but, when the cooler is in service, this box is installed on the cabinet after the latter has been lowered over the unit.

In providing means for circulating the room air through the cooler, many interesting design points had to be considered. First, a rate of air flow had to be established which would give a sufficient rate of air change in the space to be cooled, but still would not cause drafts. Tests showed that about 230 cubic feet of air per minute is suitable for the space this cooler is designed to handle.

The choice of a suitable material for the cooling compartment is an important one because of the continual presence of moisture. The cheapest metal with as great a structural strength as possible, with good corrosion resisting properties and good fabrication qualities was required, something better than ordinary sheet steel being necessary. Practically all the newly developed corrosion resistant steel alloys good enough for this application are too expensive for the purpose. Galvanized iron is cheap but the necessary straightening operations that must be performed on fabricated parts after the hot dip makes its use costly. Copper is weak and difficult to spot weld. Brass, although rather expensive, finally was decided upon because it is strong and easy to spot weld. It is oxidized to prevent the discoloring action of verdigris.

Propeller Type Fan Used

A propeller type fan with blades contoured for quiet operation and overlapped to give good pressure characteristics was selected in preference to a centrifugal blower because quieter operation is obtainable with a properly designed fan of this type. *Fig* 5 *a* shows one of the two, three - bladed, sheet - aluminum, die - formed blanks that are spot welded together to make the complete six-bladed fan shown in *b*. The use of a die to contour the fan blades and the use of the light material made it unnecessary to go to the expense of either statically or dynamically balancing the finished fan. A rubber insert completely insulates the blades from the brass hub, thus preventing the transmission of motor noise to the fan blades where it would be greatly amplified.

Shroud Ring Reduces Noise

The fan has been found to have maximum pressure and minimum noise characteristics when a shroud ring, of experimentally determined diameter, width and position with respect to the fan, is placed around it as shown in *Figs.* 2, 3 and 4.

A capacitor motor was chosen for the fan because such a motor is small, quiet, efficient, and has a good speed-torque characteristic for driving a fan. Care was taken to choose a rotor-to-stator slot combination that would not cause motor hum. The motor is insulated from the mounting platforms by four rubber grommets inserted in the motor feet, through which the four mounting bolts are placed. These rubber insulators prevent the transmission of any motor noise to the framework of the cooler where it might be noticeably amplified.

The size of the hole on top and the opening in the top grille of the outer cabinet were designed to give the air sufficient velocity so that it does not settle down heavily around the cooler, causing a cold spot there. The optimum velocity, determined by tests with smoke bombs in rooms for which the cooler is designed, is about 400 feet per minute. To prevent recirculation of the air from the high pressure outlet to the low pressure space between the cabinet and the unit, and the probable resulting condensation on the outside of the cabinet, a sponge rubber seal, ***Figs.*** 2 and 4, is placed between the top of the unit and the flanged sides of the cabinet outlet grille. This seal is cemented to the top of the unit and the cabinet grille is locked positively in place to compress this seal and prevent air leaks.

The louvres in the cabinet top grille are tipped at an angle of 20 degrees toward the front so as to throw the air toward the center of the room rather than vertically. Smoke tests in a room also determined what this angle should be.

Standard Compressor Adapted

Equally interesting are the design problems involved in the lower condensing unit portion, because a compressor of standard commercial refrigeration design had to be adapted to the special requirements, placed in a limited space, and equipped with a condenser, a liquid receiver and the other accessories necessary for a complete condensing unit.

The compressor is identical with the one used

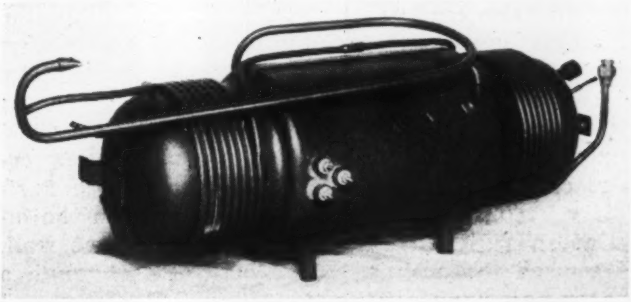

Fig. 3—(Above)—Condensing unit is made up of standard parts used on other designs of compressors, adapted to satisfy the specific needs of the new air conditioner

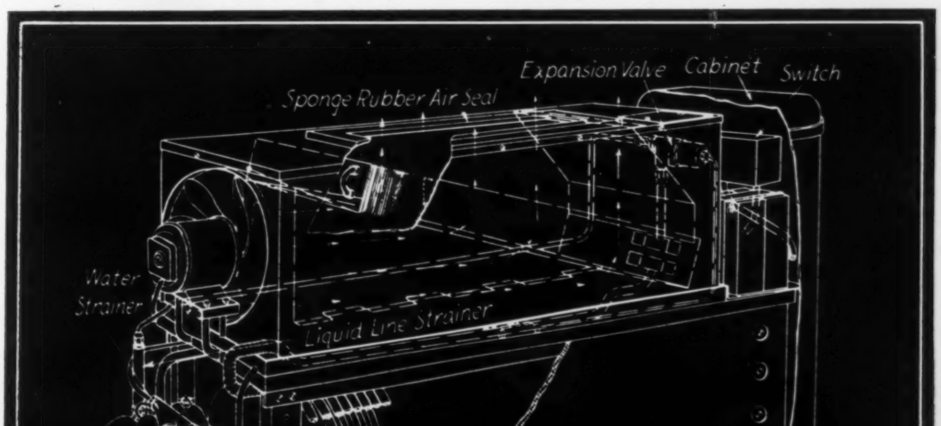

Fig. 4—(Right)—The fan has been found to have maximum pressure and minimum noise characteristics when a shroud ring of experimentally determined dimensions is employed

on the Westinghouse one-half horsepower air-cooled commercial condensing unit. However, with water-cooling, Freon refrigerant and the higher back pressures used in air conditioning, this machine will develop three-quarter horsepower. Its chief internal design features are similar to the one-eighth horsepower domestic refrigerator unit which has been discussed in detail by Messrs. Nystrom and Tull in the December, 1933, issue of MACHINE DESIGN.

Instead of one compressor with an end head welded into the open end of the compressor shell such as is described in the refrigerator article, the room cooler consists of two compressors in two such shells assembled end to end as in *Fig. 6*. Each compressor also has two cylinders set in "V" instead of one, making a total of four cylinders for the unit. The compressor described by Messrs. Nystrom and Tull was designed for sulphur dioxide. The Mobilaire compressor is adapted for the use of Freon, a much denser gas, and has, therefore, larger internal tubing, larger holes in the suction and discharge muffler baffles, and larger passages in the cylinder heads and around the suction ports. Two solenoid valve unloader mechanisms are used. Instead of the heat, dissipating fins such as are used on the outside of the shell of the aircooled machine, a cold water coil is wound around and soft soldered to each shell of the unit to dissipate the heat of the motors, see *Fig. 6*. The three supporting feet on the aircooled machine have been replaced by two feet on each shell which are drilled and tapped from the bottom.

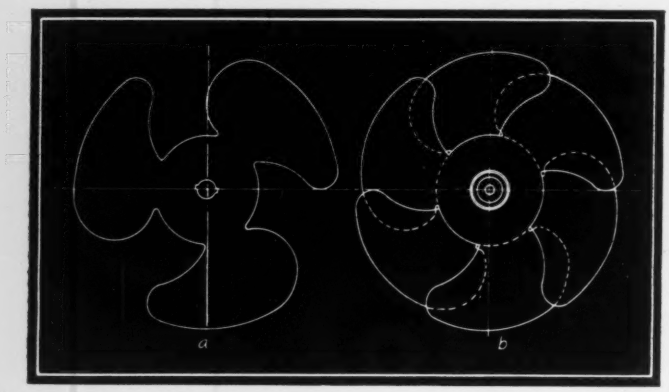

Fig. 5—Blades of welded aluminum propeller-type fan are contoured for quiet operation

Spring Supports the Unit

Two brackets, each of which carries two spring wells, are fastened to each end of the compressor unit. The unit is supported on four coil springs from these points. A bolt is placed up through the cross-member and through the center of each spring to keep the compressor properly aligned.

These compressor mounting brackets have flat strap extensions on them which run parallel to the shells for carrying the condenser. The latter is a double-tube, helical condenser wound in two sections, as illustrated in *Figs.* 3 and 4, and joined at the center with a sleeve connector on both the inside and the outside tubes. The condenser section which passes out of the compartment to the liquid receiver is arranged with the last two turns free from the compressor to make a flexible connection.

Flexibility Is Insured

A noteworthy system of piping the cooling water and the refrigerant has been worked out. The cooling water, which may be low enough in temperature to cause collection of moisture on the pipe, is brought into the inside of the condenser coil. There is, therefore, no danger of sweating taking place on the cooling water line except on the short length of tubing under the liquid receiver which can be insulated. After passing through both sections of the condenser the water passes into the compressor cooling coils and thence back to the fan end of the unit again. Passing the cooling water through the condenser first, gives the condenser the full benefit of cooling water at the lowest available temperature and makes use of the discharged condenser water to carry away motor heat without increasing the quantity required for the unit. As the water leaves the compressor, enough free tubing is left to insure flexibility before the pipe passes out through the insulation wall. Outside the compartment wall, it passes through a water strainer, through a water flow regulating valve which allows enough water to pass to hold a constant discharge pressure on the condensing unit, and thence to the water return line.

Expansion Valve Employed

The refrigerant is supplied to the expansion valve and the cooling coil from the liquid receiver through a strainer. It returns to the compressor through the long suction line which assures a flexible connection to the compressor. Felt insulation is placed on this tube to prevent condensation. From the discharge tube of the compressor unit, the hot gaseous refrigerant enters the end of the condenser at which the cooling water leaves it, and empties a condensed liquid into the receiver.

All joints in copper tubing between copper and steel, and between copper and brass, are made with hard solder or brazing wire. Two special filler plug connections are supplied for gauging pressures and for charging the unit. One is on the compressor unit shell where the suction pressure may be measured and where refrigerant may be added while the compressor runs. The other is on the liquid receiver where the head pressure may be measured.

SCANNING THE FIELD FOR IDEAS

MAKE THE OPERATOR'S JOB EASIER!

THESE columns long have encouraged designers to give more consideration to the operator. It has been emphasized that, among other things particular effort in this direction will do much to rout criticism that mechanical devices are making slaves of mankind. Indicative of the trend toward the utilization of available power to replace physical effort is the Harnischfeger mechanical dipper trip for power shovels. The company claims that this device saves the operator approximately 1500 tiring motions per shift or a total of 15,000 foot pounds per day in operating a shovel.

The dipper trip requires only a slight pressure on trigger *A, Fig.* 1, similar to that employed in squeezing the trigger of a pistol. This engages a spring mechanism on the trip assembly *B,* engaging a jaw clutch to cause eccentric sheave *C* to revolve with the digging drum. Cable reeving is arranged as shown in *Fig.* 1. Cable *D* extends from the latch lever *E* on the dipper, over sheave *F* on the shipper shaft down through the cab and over the eccentric sheave on the drum shaft extension. From here it returns to a drum located alongside sheave *F* on the shipper shaft, where after several wraps around the drum it is dead ended.

As the eccentric sheave revolves it pulls on the cable which releases the latch lever on the dipper. After one revolution the eccentric sheave returns to its original position and tension on the cable is released, allowing the latch on the dipper door to slide back into place.

It will be seen that waste motion is eliminated because it is unnecessary for the operator to remove his hand from the hoist lever to empty the dipper of the shovel.

DESIGNING FOR RURAL MARKETS

ALERT designers are studying the rural markets as an outlet for various types of equipment now purchased only in the more industrialized and built-up centers. It is true that electric power, for instance, is now available in many agricultural districts but there remains an extensive field where it is necessary to design machines especially suitable for the prevailing conditions.

One company that has anticipated this market is the Waukesha Motor Co. which recently introduced a line of rural refrigeration apparatus developed around the gasoline engine as a source of power. It is interesting to observe the several fundamental requirements laid down for the designers to follow in developing a gasoline ice engine.

The same ice power unit had to be adapted to the three basic rural needs: A domestic refrigerator, *Fig.* 2, domestic ice making unit, and a milk cooling machine. Each had to be portable, simple and moderate in price. To fit these conditions, the power plant was designed with a single cylinder gasoline engine directly connected and built as a compact unit with the compressor. This was mounted on a hollow base which serves as the fuel tank and support to which the steel

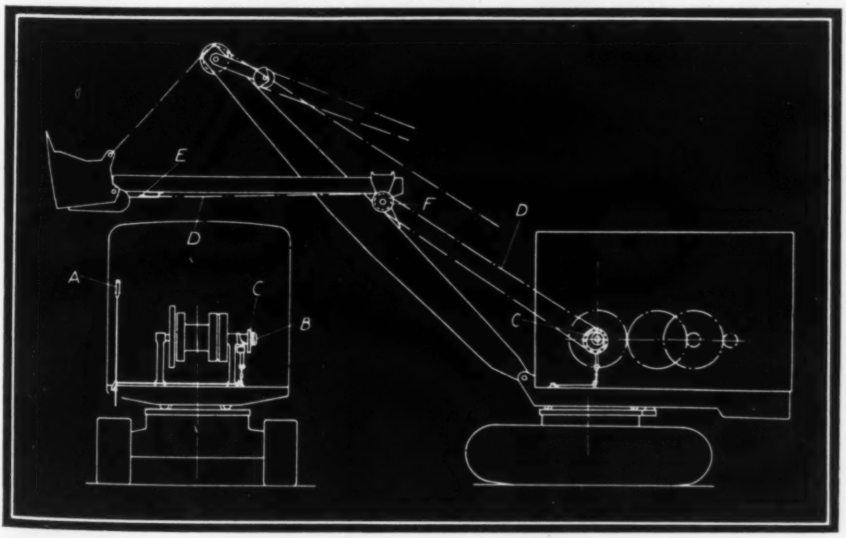

Fig. 1—*An eccentric sheave relieves the shovel operator of tiring motions in tripping dipper*

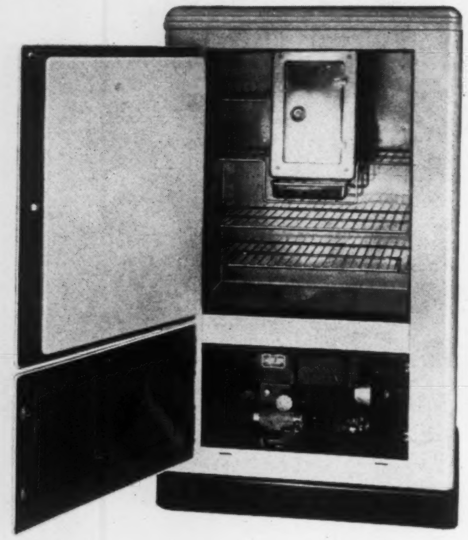

Fig. 2—Gasoline engine is employed to furnish power for rural refrigeration

refrigerant receiver is strapped. Above the engine and protected by a heat insulated housing and a shroud is a refrigerant condenser. The entire power plant occupies a space less than eighteen inches square and high.

The domestic refrigerator employs an old basic refrigeration principle—it uses a refrigeration accumulator. In the space ordinarily occupied by the evaporator and cube tray support is a tank filled with an alcohol solution which freezes at twenty degrees. In the hollow chamber in the center of this tank, ice cubes and desserts are made. The frozen accumulator serves in the same way as a fifty-pound cake of ice in an ordinary refrigerator except that the temperature is maintained at a much lower figure. In ordinary operation it only is necessary to operate the refrigeration mechanism for two or three hours—sufficient to freeze the accumulator, after which the latter does the work for the remainder of the day.

BEARING FOR HIGHER LOADS, SPEEDS

IN THE machine parts field bearings of the high-leaded bronze, steel-backed type are offering designers, particularly in the automotive industry, marked possibilities. Their ability to withstand higher loads and speeds indicates that engine speeds may be increased considerably by their adoption. By permitting the use of narrower bearings there is a possibility also that a reduction in the overall length of engines may follow in the wake of this development.

The AC Spark Plug Co. at its Flint, Mich., plant is in production on these bearings. The use of high-leaded bronze bearings is not new, however. They are used widely today in aircraft engines and largely are responsible for the high output of such engines. While it is not expected that the automotive industry as a whole will discontinue the use of babbitt-lined main and connecting rod bearings, a number of important truck engine builders and two major auto manufacturers already have adopted the high load capacity types. Indications are that several more will follow when 1935 models are introduced.

USING STANDARD COLD DRAWN SHAPES

DESIGNING to reduce production costs holds tremendous possibilities where materials are involved. Standard cold drawn shapes for example are being utilized to produce parts such as the spindle, *Fig.* 3, used on a textile machine. This part formerly was made from a casting and now is being turned from round cold drawn bar stock on an automatic screw machine.

The spindle is machined from 2-5/16-inch round bar tapered to approximately 1¼ inches at the top. Despite the fact that there is considerable machining and a large amount of scrap results, it has been found possible to produce this part from cold drawn steel at a savings of 13 cents per unit. The Union Drawn Steel Co., Massillon, O., is furnishing the material.

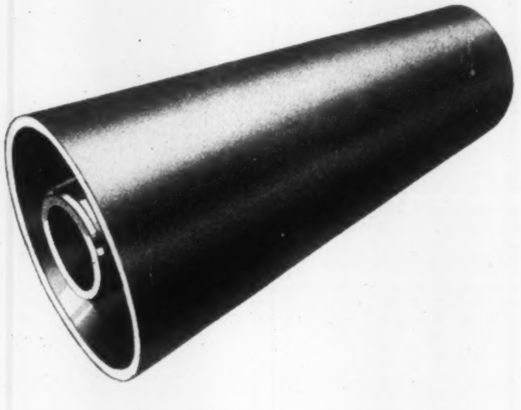

Fig. 3—This taper spindle is produced from a standard cold drawn bar on automatic machine

NEW MATERIALS AID TRANSPORTATION

CHECKING over the recent exhibit of the American Transit association at Cleveland, editors of MACHINE DESIGN found that materials are continuing to play an increasingly important part in the design of transportation equipment. One surface car designed by Pullman Car & Mfg. Corp. and demonstrated, employs aluminum for the body framing, using interlocking extruded material of specially designed sections. Aluminum castings are utilized where complicated shapes make this desirable. Sheeting also is aluminum.

Another surface car built by the same organization has a body constructed of "Cor-Ten," a low chromium alloy which provides light weight combined with high strength and high corrosion resistance. The entire framing structure presents radical departures from conventional car practice and is intended to provide a design capable of cheap and rapid fabrication.

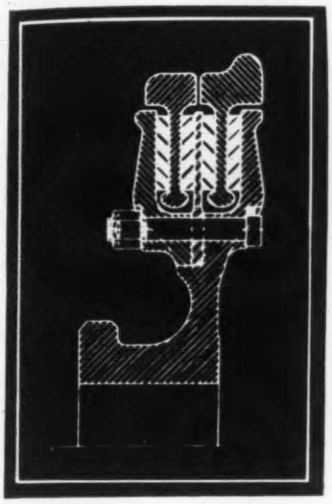

Fig. 4—Noise and vibration now are being combated by resilient wheels, typical of which is the one at the left. Four rubber rings are interposed between the tire and the hub sections to act as the insulating medium

The Brill surface car also exhibited, has body framing constructed of carbon steel in the form of rolled sections and formed sheets. Parts are welded together in some cases and riveted in others. Side sheets are 13 gage copper bearing steel riveted to the frame.

Use of resilient wheels also was outstanding among the innovations. Construction of the Brill wheel is shown in *Fig.* 4. Four rubber rings in both shear and compression act as the noise eliminator between the tire portion and the hub section. A flexible copper strip inside the wheel serves as the electrical connection between the rubber-separated metal parts. Eight heavy bolts are employed to hold the wheel together.

WHICH COLOR FOR MACHINES?

COLOR in the finishing of machinery is a topic of much current discussion. From England comes a brief pertinent comment on the subject which brings out that the engineering industry in that country also is waking up to the importance of the psychological effects of color on its employes. An example of this is the painting of new machinery at the Armstrong-Siddeley car and aero engine factory in Coventry in a quiet soft shade of green instead of the usual black or gray.

Green was chosen because, being the middle color of the spectrum, it is restful to the eye. Men working on a green machine would, it is argued, do better work. Another reason for its choice is that it shows up oil leaks or dirtiness which a darker color would tend to hide. The green machinery therefore encourages cleanliness and with it efficiency, the announcement declares.

This point of view is somewhat controversial. Some engineers prefer to employ a color that will not show up oil stains or smudges caused by grease on the hands of the operator.

EQUALIZING CABLES BY LEVERS

IDEAS spring from many sources. In an elevator hoist cable equalizer, *Fig.* 5, for example is a principal that might provide engineers with food for thought. This is a lever type six-cable equalizer in which each pair of cables is equalized by a single lever to which it is attached. Three pairs of cables are equalized by the lower set of levers.

As shown in the phantom sketch the first and third pairs of cable are connected to lever *A* having a fulcrum at *B*. The center or second pair of cables connects with level *C* with a fulcrum at *D*. Levers *A* and *C* are connected by rod *E* to complete the equalizing mechanism.

It is desirable in this type of unit that the lever arm lengths be at least several times the bearing diameters, while being designed as short as possible to keep the cables close together. The bearing combination recommended is hardened and polished fulcrum pins operating in self-lubricating bearings.

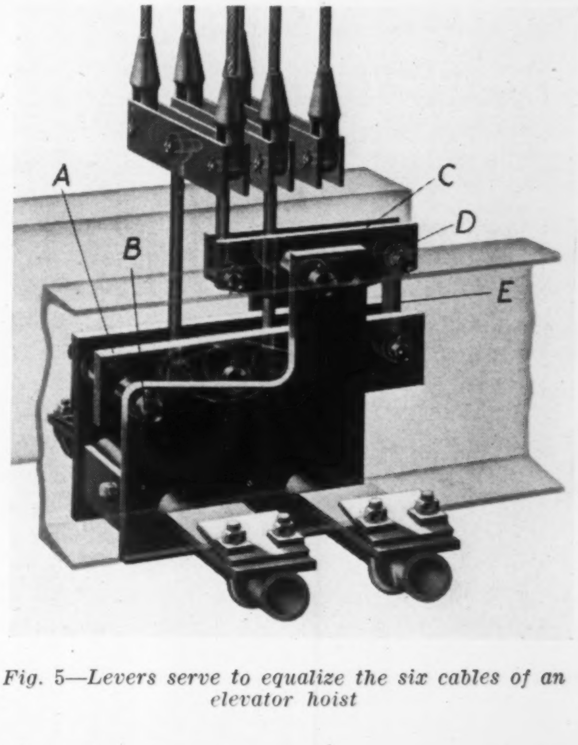

Fig. 5—Levers serve to equalize the six cables of an elevator hoist

Shaftless Motor

By Allen F. Clark

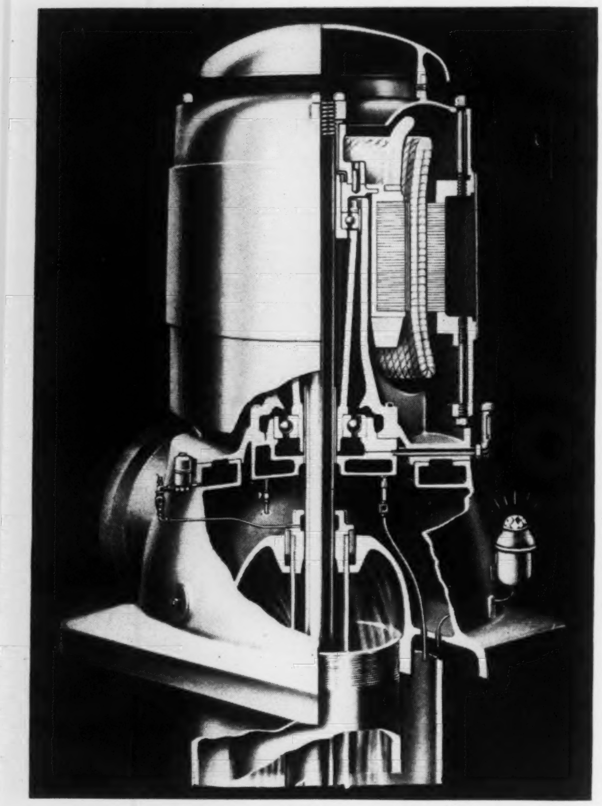

Fig. 1—Rotor core is hollowed out to make room for pump bearing on the interior of the core

REDUCTION of all machinery to the simplest arrangement of parts, the trend toward the elimination of all parts not absolutely essential and the demand for beauty of line have placed restrictions on design that have necessitated a complete realignment of the engineer's thinking. Of these three factors, beauty of line appears to be the greatest motivating force, but the appearance of the present-day machine is not the result of an attempt at decoration. Machines are becoming more attractive because they express in every line of their structure the purpose of their parts. Beauty is, in the final analysis, a practical consideration.

All the foregoing factors have one characteristic in common—they limit the space available for location of the motor. However, this limitation of space is not, today, a hardship, as many engineers prefer to design the motor as an integral part of the machine combining certain motor and machine parts such as shaft, bearings and housing so that the complete power unit is blended into the general design of the machine. A comparatively few years ago, such design was subject to considerable limitations as there was not then available, as there is now, a complete line of motors intended for building into the machine. The need for motors of this type has naturally been answered by a most advantageous increase in the type, size, speeds and make of motor available. Where the driven machine requires power at several different places, direct motor drives included as an integral part at the point where they are needed have been the practical and economical solution of the problem.

Design Freedom Possible

One of the most adaptable of the several types of motors available for building into machines is the shaftless type. In the use of this type the designer has complete control of the size, lubrication and location of bearings, providing that the rotor is properly supported; length and characteristics of the shaft; and location of the motor. The designer must, of course, provide sufficient space for location of the rotor and stator of the motor, and be certain that the motor receives proper ventilation, but his freedom in other design details greatly enhances the possibility of securing a most compact design.

One type of these shaftless motors consists essentially of stator and rotor with all mechanical parts omitted. The stator laminations may be assembled inside of a steel shell which is

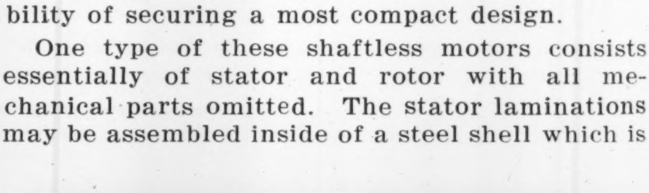

Fig. 2—High speed motor is built into this oil burner to form a complete integral unit

Ease Design Limitations

ground on the outside to a given diameter with close tolerance to facilitate mounting. A variation of this design is to assemble and rivet together the primary laminations; then the external diameter of the assembled laminations is turned and ground to a close tolerance. The stator can be held in the housing by means of set screws, preferably placed diametrically opposite, or may be a press fit in the housing. Coil ends are carefully protected against the action of moisture, oil and dust and against mechanical injury. The rotor is of the conventional squirrel cage construction, finish ground to insure uniform air gap. There are available rotors with a standard taper and no keyway, and rotors with a straight bore and with or without keyway as required. The rotors are furnished statistically balanced, but the final or dynamic balance is possible only after the rotor is assembled on the machine shaft.

Should Provide Two Bearings

The practice of mounting these motors in such a manner that the whole weight is supported from one end is not recommended by the manufacturers. With a long unit of small diameter, it is desirable to provide the rotor with a bearing at each end. When designing a housing for the motor, ease of assembly and disassembly should not be overlooked. Dirt, bearing troubles or other causes may necessitate the future taking down of the assembly. Ease in accomplishing the removal and replacement of any unit is frequently of great importance.

As the physical dimensions of the motors have been minimized, adequate ventilation is especially important. Recommendations for ventilation call for, in general, about 100 cubic feet per minute of free air for kilowatt loss in the motor. There is also a "rule of thumb" by means of which an ample amount of ventilating air can be quickly ascertained. This is to provide 10 cubic feet per minute of free air for each motor horsepower. This amount is approximately correct for all these shaftless motors up to 3 horsepower and is quite liberal for the larger sizes. To utilize the first rule, allow 85 per cent as efficiency for motors of 4 horsepower and below, and 90 per cent for larger motors.

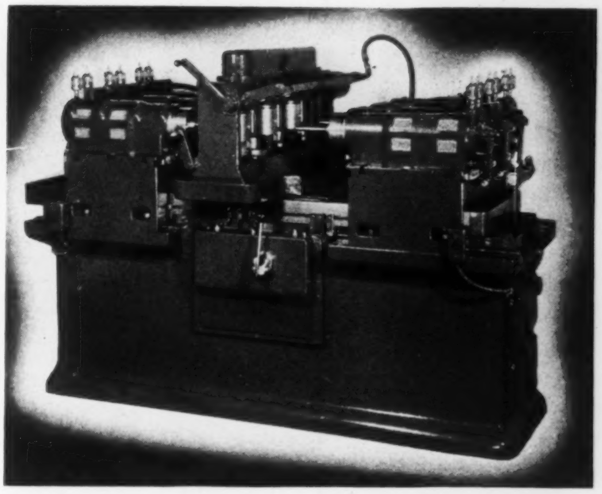

Fig. 3—Close centers are permitted on boring machine employing shaftless motors

It should be remembered that the motor capacity increases as the speed is increased and that, if capacity loads exist at top speeds, the motor ventilation should be considered at maximum operating speed. Also, it is best to make sure that the proper amount of air is available when the speed is reduced.

Ventilation Is Desirable

Directive ventilation over the outside surface of the stator may be provided by longitudinal air ducts on the inside of the housing. Air may be taken in at one end, passed over the coil ends, over the exterior and out the opposite end over coils, or a more effective method is to take the air in at each end and discharge it through openings at the middle part of the housing. The air inlet should be located so that the air supply is clean and free of foreign material, and falling material cannot normally enter. Screens are extremely likely to fill up with dust and cut off the air entrance. Suitable shields or baffles are decidedly preferable.

In order to meet the dirt conditions prevailing in many locations, specially constructed totally enclosed fan-cooled motors for building into machines have been developed. This design does not materially increase the motor dimensions. Radiating fins will aid materially in keeping down motor temperatures. Motors using the totally enclosed, fan-cooled construction will exceed the standard open rating temperatures, but will not exceed a safe operating temperature under normal operating conditions. The suction-type fan is preferred for the same reason as it is preferred for shaftless motors of standard construction, that is, because the air is distributed over as much surface as possible.

Many Types Available

The many available speeds and multiplicity of characteristics available to the designer in the shaftless motor gives a practically complete range from which the right type of motor may be selected. The successful application of these shaftless motors to machinery, with the numerous variations in mounting and ventilation, depends to a large measure upon close co-operation between the machine builder and motor manufacturer at the time the design originates. With a free exchange of ideas covering details of motor mounting, ventilation and character of the load, the design of a proper mounting for this type of motor is not difficult.

Although applications for these motors first originated in the woodworking field, their use has been extended until at the present time many types of machine tools employ them. They have also found application in food mixers, adding machines, oil burners, automotive equipment, pumps and other types of appliances.

The flexibility possible with the use of built-in motors is indicated by the motor pump shown in *Fig.* 1. Here the rotor core is hollowed out to make room for the pump bearing on the interior of the core in order to conserve space. A high speed motor built into an oil burner is shown in *Fig.* 2.

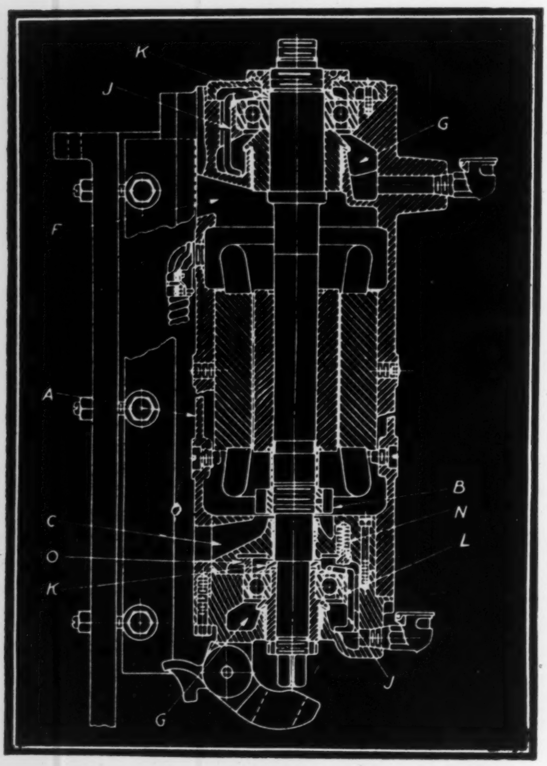

Fig. 4—*Employment of built-in motor permits use of parts for multiple duties*

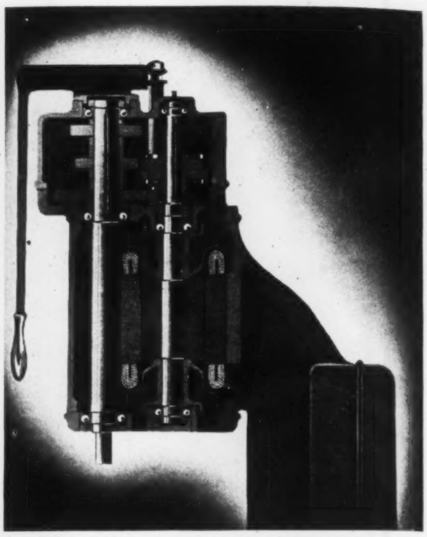

Fig. 5 — *Drill head sensitivity is enhanced by the employment of a motor as an integral part of the head*

In order to give a more complete picture of the design factors to be considered, it might be well to consider the design of a high grade shaper spindle, *Fig.* 4. The drawing does not show the separable top section of the spindle. This is located about a foot above the top bearing. It will be seen that part *A* serves not only for the motor but also for the upper bearing housing; the lower end being bored concentrically provides a means of locating accurately the lower bearing housing. This construction insures perfect alignment of the bearing with respect to the stator. The one-piece construction of the motor and the upper bearing housing makes the slide especially rigid.

Fan Serves as Ring Nut

The motor in this shaper slide is ventilated by means of fan *B* which sucks air through port *C,* blows it against the winding and up between the stator shell and the housing wall. It then comes in contact with the other end of the stator winding and passes out through exhaust port *F.* It will be noticed that the fan serves also as a ring nut for clamping the rotor in position on the spindle.

In both upper and lower housings a reservoir *G* is placed beneath the bearing. The oil level is regulated by the filler cup. Wick *J* draws oil by capillary attraction from the reservoir to oil slinger *K* above the bearing. This slinger is in light rubbing contact with the wick and due to its rotation expels oil from the wick in a fine mist or spray. This mist which permeates the housing lubricates the surface of the bearing and eventually drips back into the reservoir.

In spite of precautions against undue heating it is impossible to prevent a rise in temperature in spindles of this type. The temperature rise will cause a slight expansion of the spindle over that of the surrounding parts. To prevent spindle distortion or overloading of the bearings the lower bearing is made to "float." This bearing *L*, although mounted rigidly to the spindle, is free to move axially in its housing. In addition, springs *N* apply a constant pressure by means of spring plate *O* to the outer race of the bearing. The pressure tends to crowd the race downward, putting a slight thrust load on the bearing. This load also is communicated to the upper bearing in addition to the weight of the spindle and assembled parts.

Compactness Aids Design

Compactness of the improved shaftless motors contributes materially to the ease of incorporating them in the design of machines that employ several motors located very close together, as can be seen from the double-end precision boring machine in *Fig.* 3. This machine uses six of these motors. *Fig.* 5 shows the installation of a shell-type motor in a sensitive drill head, while a swing saw for side mounting is similarly equipped. *Fig.* 6, as is also the spindle of the machine in *Fig.* 7. This latter machine employs an auxiliary drive belted to the spindle.

For their considerate co-operation in the preparation of this article and for the illustrations used, MACHINE DESIGN wishes to acknowledge the assistance of the following: Louis Allis Co., Milwaukee; Bodine Electric Co., Chicago; General Electric Co., Schenectady, N. Y.; Ohio Electric Mfg. Co., Cleveland; U. S. Electrical Mfg. Co., Los Angeles, and Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

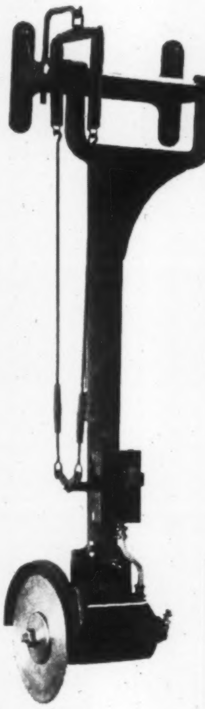

Fig. 6—(Left)—Shell-type motor on swing saw permits compact design of the working head

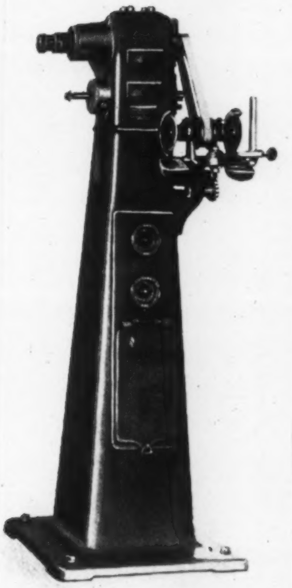

Fig. 7—(Right)—Building in of motors is simplified by application of the shaftless type

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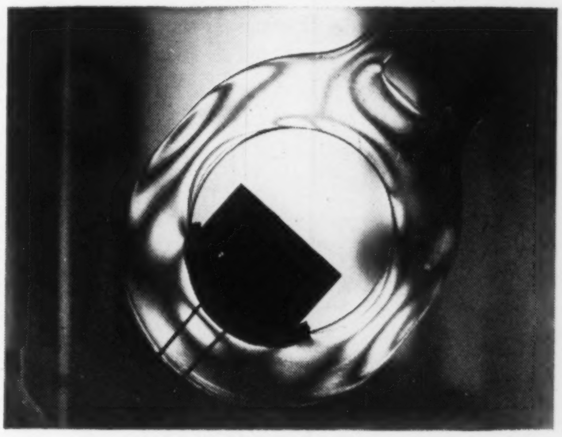
Photoelasticity Authenticates Design

IN THE design of a yoke for use in connection with a very large and heavy bending roll, it was decided to fabricate the part by a casting—any other construction seemed entirely unfeasible—to be made of high tensile electric furnace steel and to weigh about 11,000 pounds. The part was to be called on to resist direct loads up to 1,650,000 pounds normally and loads to probably more than twice this value occasionally, while being subjected at times to a side load of much smaller magnitude producing a transverse bending in a vertical plane. The shape of this part together with the manner of loading made analytical investigation difficult.



Stressed model indicates absence of dangerous stress concentrations

When a scale model in steel plate of this piece was tested by tensometers, engineers of Baldwin-Southwark Corp. believed that some of the results did not seem consistent with others. It was suspected that the stress changes were rapid and the fact that the tensometers had a minimum gage length of one inch made it impossible to detect sharp stress gradients suspected to exist. It was decided, therefore, to pursue the matter further and investigate the stress distribution by photoelastic methods. Since any primary desideratum was the detection of dangerous stress concentration, if any, and not a quantitative analysis, the problem was rendered relatively simple. A view of the stressed model viewed in panchromatic polarized light is shown herewith, and as may be readily seen no dangerous stress concentration is present. Therefore, the part could be constructed with a reasonable assurance that given a normal casting no field failure was probable.

Gun Lathe Incorporates Unique Screw-Cutting Mechanism

By M. M. McCall

WHEN performing threading operations on standard lathes, the thread is caught for successive cuts by closing a split nut on the leadscrew at the proper time as indicated by a dial on the carriage. As the design of the large Bement gun lathe shown in *Fig.* 2 dictated that the leadscrew be fixed, an entirely new problem was presented. It became necessary to catch the thread by the engagement of the feed clutch; which, when used for this purpose on other machines, is often made with one tooth and caused to make one revolution during one revolution of the spindle.

But the feed clutch on the carriage of this large lathe is between the feed change gears and the rotating nuts, actuated by separate motors for rapid power traverse, to permit the use of the same gears to provide the cross feed to the cross slide. It therefore would not have a constant ratio with the spindle for different pitches, and as a 1-tooth clutch would delay the engagement of the regular feeds, a multiple tooth clutch was considered more desirable. Consequently, the designers were confronted with the problem of providing means to maintain, at all times when threading, the relation between the rotary motion of the spindle and the movement of the carriage along the bed, and indicate the time when the multiple tooth feed clutch could be engaged to catch the thread.

Indicating Mechanism Described

Fig. 1 shows the assembly of the indicating mechanism located in the cylindrical shaped casting on top of the apron (see *Fig.* 2). *Fig.* 3 is a sketch showing a part of the feed gear train which is sufficient to explain the indicating mechanism. The gear on shaft *CD* is driven by the feed change gears and the sketch shows the gear train from this point to the rotating nut. The power traverse shaft will traverse the carriage when the traverse clutch is engaged; this clutch being interlocked with the feed clutch to prevent their simultaneous engagement. The purpose of the extra 54 and 12-tooth gears between shafts *CA* and *CB* is to connect shaft CB and the indicator with the rotating nut at all times regardless of whether the feed clutch is engaged or disengaged. The

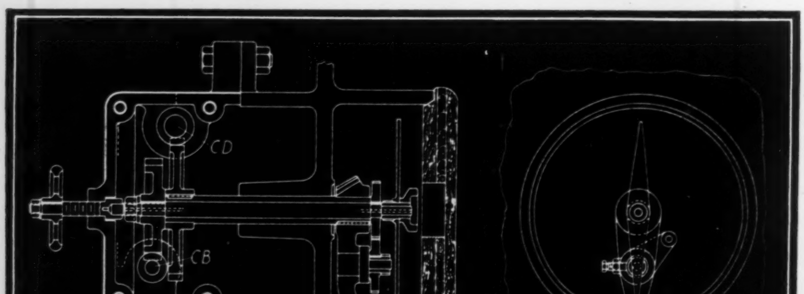


Fig. 1—Feed clutch on the carriage of large gun lathe is between the feed change gears and the rotating nuts

shafts CD and CB will therefore rotate at fixed ratios with the spindle and rotating nut respectively.

Worm teeth on shafts CD and CB drive the worm wheels in the indicating mechanism and rotate the sleeve and center shaft respectively. An arm is keyed to the upper end of the sleeve and a 60-tooth gear to the center shaft. This gear meshes with a 60-tooth gear on the arm to which is keyed a 20-tooth gear in mesh with an idler. The idler can be swung into mesh with different change gears loosely mounted on the end of the center shaft and to which a double-ended pointer is clamped so that one end registers with a mark on the arm when the feed clutch is engaged for taking the first cut on the thread.

Gives Pitches to be Cut

The following table gives the pitches to be cut on the lathe and the change gear to be used for each pitch. The indicator is designed to accommodate the largest and smallest change gears.

Change gears for indicator

Pitches	.5	.625	.70	.75	.80	1	1.25	1.5	1.75
Gears	20	25	28	30	32	40	50	60	70

When the feed clutch is engaged, suitable ratios of the driving worms and wheels cause the indicator arm and center shaft to make an equal number of revolutions in the same direction. This number of revolutions is made equal to the number of inches in the carriage along the bed and will be equal to the pitch during each revolution of the spindle.

(For 3/4-inch pitch, $3/4 \times 1/3 \times 32/15 \times 30/16 \times 54/12 \times 45/15 \times 2/36 = 3/4$, and $3/4 \times 1/3 \times 32/15 \times 30/16 \times 54/12 \times 4/24 = 3/4$.)

The equal number of revolutions of the indicator arm and shaft will cause the planetary gears to be locked without any rotation on their centers. Also, the pointer will travel at the same speed and in the same direction as the arm regardless of the number of teeth in the change gear. This is always the case when the feed clutch is engaged.

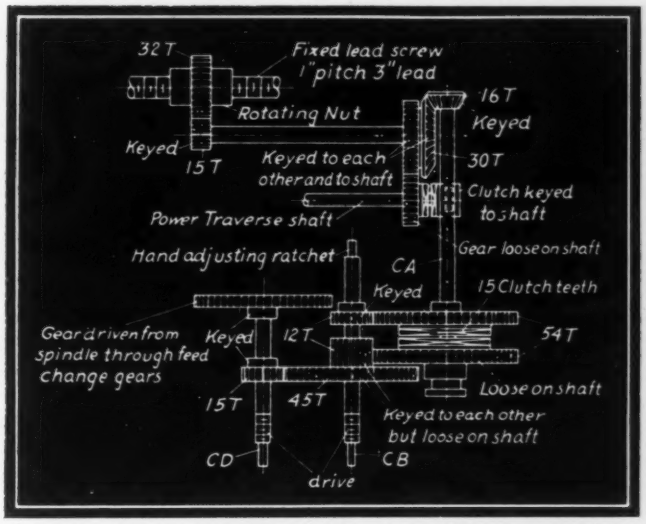


Fig. 3—Details of feed gear train

When the feed clutch is disengaged, the arm will continue to make a number of revolutions equal to the pitch for every revolution of the spindle, but the indicator shaft will cease its motion. The 60-tooth gear on the arm will, therefore, rotate with a planetary motion around the fixed 60-tooth gear on the shaft. As the arm makes a number of revolutions equal to the pitch for each spindle revolution, the pointer, due to the planetary action of the gears, will make the same number of revolutions in the same direction and also an additional number of revolutions. These additional revolutions will be equal to the number of revolutions of the arm times the ratio of 20 to the number of teeth in the change gear.

Formula Expresses Relations

This relation is expressed by the formula, $p \times 20/x$=additional revolutions of the pointer, p being the pitch and x the number of teeth in the change gear. A little study will show that if the pointer makes an additional half revolution during every revolution of the spindle, both ends of the pointer can be used as indicators. First one end and then the other will register with the arm at every revolution of the spindle and indicate this time as the proper time to engage the clutch to catch the thread. The for-

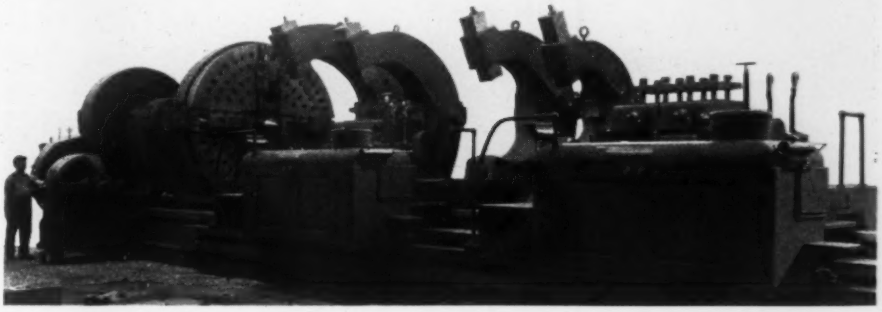


Fig. 2—Redesigned indicating mechanism is located in the cylindrical shaped casting on top of the apron on this lathe

mula therefore becomes $p \times 20/x = 1/2$, and solving $x=40p$.

Each revolution of the spindle will be the proper time to catch the thread provided the carriage does not move, or moves an amount equal to the pitch or a multiple of the pitch. If the carriage moves a different amount, the indication will occur at the fraction of a spindle revolution which coincides with the fraction of the carriage movement between multiples of the pitch. This relation will be shown by example later in this article.

While larger or smaller change gears cannot be used with the indicator, finer or coarser pitches can be indicated as follows.

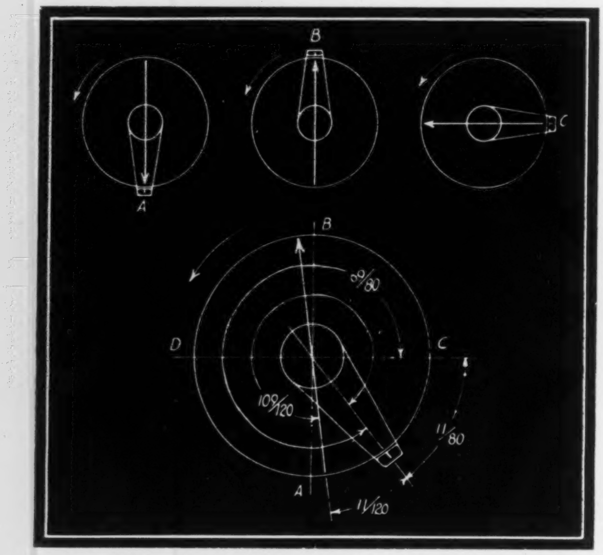


Fig. 4—Relation is maintained between movement of spindle and carriage during complete pass

For a pitch of 2½ inches the change gear would have 100 teeth. By using a change gear with half the required number of teeth, the additional number of revolutions of the pointer will be increased from ½ to 1 revolution. This will necessitate catching the thread with only one end of the pointer, which will be the same end that registers during the first cut.

For a pitch of ¼ inch the change gear would have 10 teeth. If the pointer is given one-fourth additional revolution instead of one-half, a 20-tooth gear can be used and the thread caught with both ends of the pointer. However, the pointer and arm will only register at every second revolution of the spindle.

Registers Every Fourth Revolution

For a pitch of ⅛ inch the pointer can only make one-eighth additional revolution to use a 20-tooth gear, and it will only register at every fourth revolution of the spindle.

As described in the foregoing, the indicator indicates the proper time to engage the clutch to catch the thread. However, it is also necessary that the clutch teeth register to complete the operation. A study of the table will show that two of the pitches are in tenths and one in eighths. If the clutch is made with 15 teeth, it will turn 2 teeth for every 1/10-inch movement of the carriage as $1/10 \times 1/3 \times 32/15 \times 30/16 = 2/15$, and 2/15 of 15 = 2. It will also turn 5 teeth for every ¼-inch movement as ¼ = 2½ tenths. The clutch teeth will therefore register to catch the thread for all of the pitches in the table with the exception of ⅝-inch. When the spindle makes one revolution and the carriage moves ⅝ inch, the clutch will turn 12½ teeth, requiring two revolutions of the spindle to obtain a whole number of teeth. The thread can therefore only be caught when one end of the pointer registers with the arm and this end will be the one that registers during the first cut. Also, when cutting ⅛-inch pitch, the clutch will turn 2½ teeth for each revolution of the spindle. But as the pointer only registers every fourth revolution of the spindle, the clutch will turn 10 full teeth during this period.

Example Is Given

The following example shows how the relation is maintained between the movement of the spindle and carriage during one complete pass of the threading tool. Even figures are used for simplicity. Suppose a thread with ¾-inch pitch is being cut; the carriage movement is 22½ inches; the spindle makes 3 revolutions per minute and the traverse is 60 inches per minute. Also, at the start of the carriage movement, suppose the arm and pointer register at *A* in *Fig.* 4, top left. They will move together in the direction indicated, to *B* in *Fig.* 4, top center, at the end of the carriage movement. At this point the feed clutch is disengaged and we will assume that the spindle makes one revolution before the return traverse is engaged. During this revolution, the arm will travel ¾ of a revolution to *C* in *Fig.* 4, upper right, and the pointer will travel 1-¼ revolutions, its opposite end registering with the arm.

Traverse Is Engaged

The traverse is now engaged, and as the carriage is never returned exactly to its starting position, we will assume that its return movement is 23 inches. The traverse therefore, will require 23/60 minutes, and the spindle will make 1-3/20 revolutions during this time. As the indicator arm makes ¾ of a revolution to one of the spindle, the arm will make 69/80 revolution during the traverse and will be at the position shown in the lower drawing in *Fig.* 4. During the 23-inch return traverse of the carriage, the indicator shaft will make 23 revolutions in the opposite direction to the motion of the arm. To ob-

(*Concluded on Page* 67)

Determining Shaft Strength

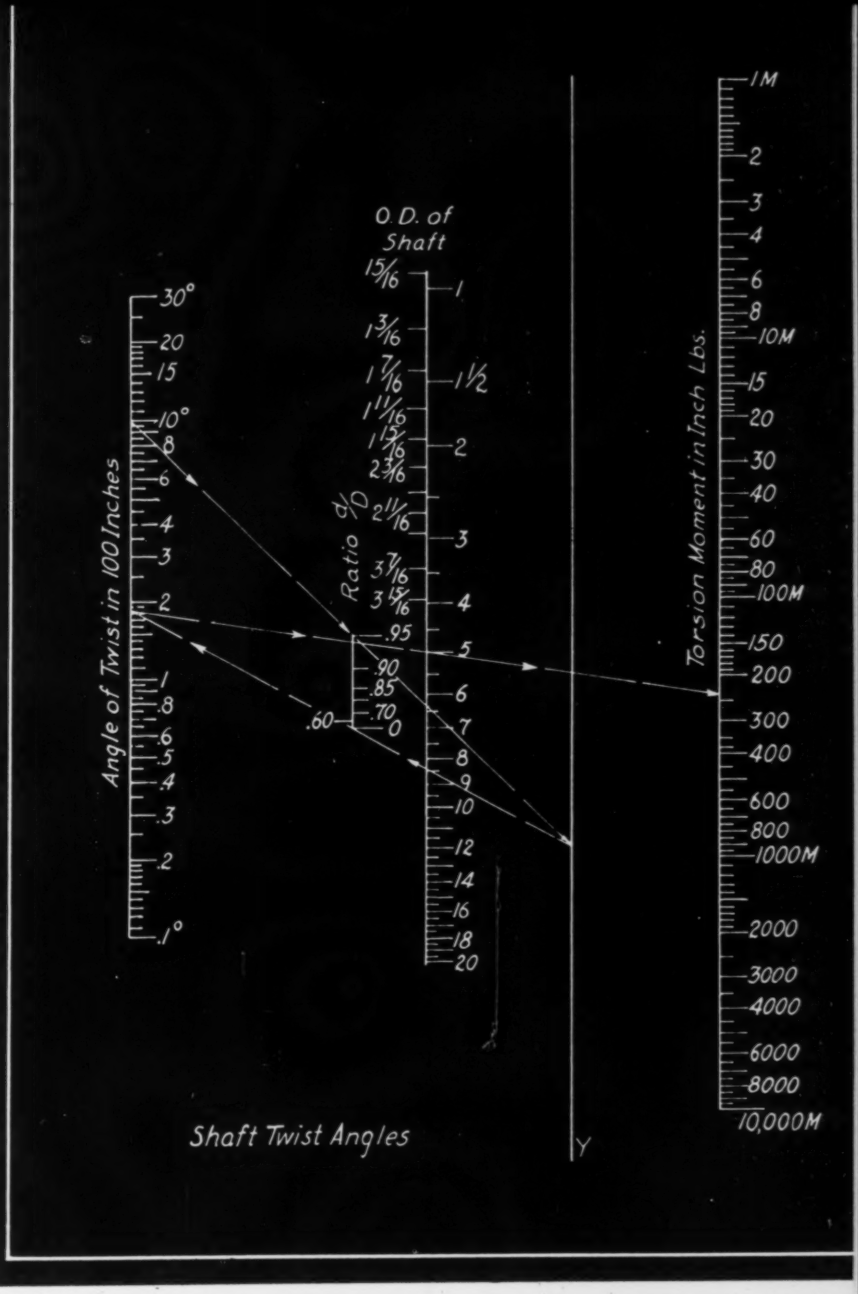
By John S. Carpenter

THE two accompanying nomographs make possible the rapid solution of shaft strength and angular twist problems starting from any desired unknown. In addition, a supplementary scale on each nomograph makes possible a comparison of hollow shafts with solid shaft results.

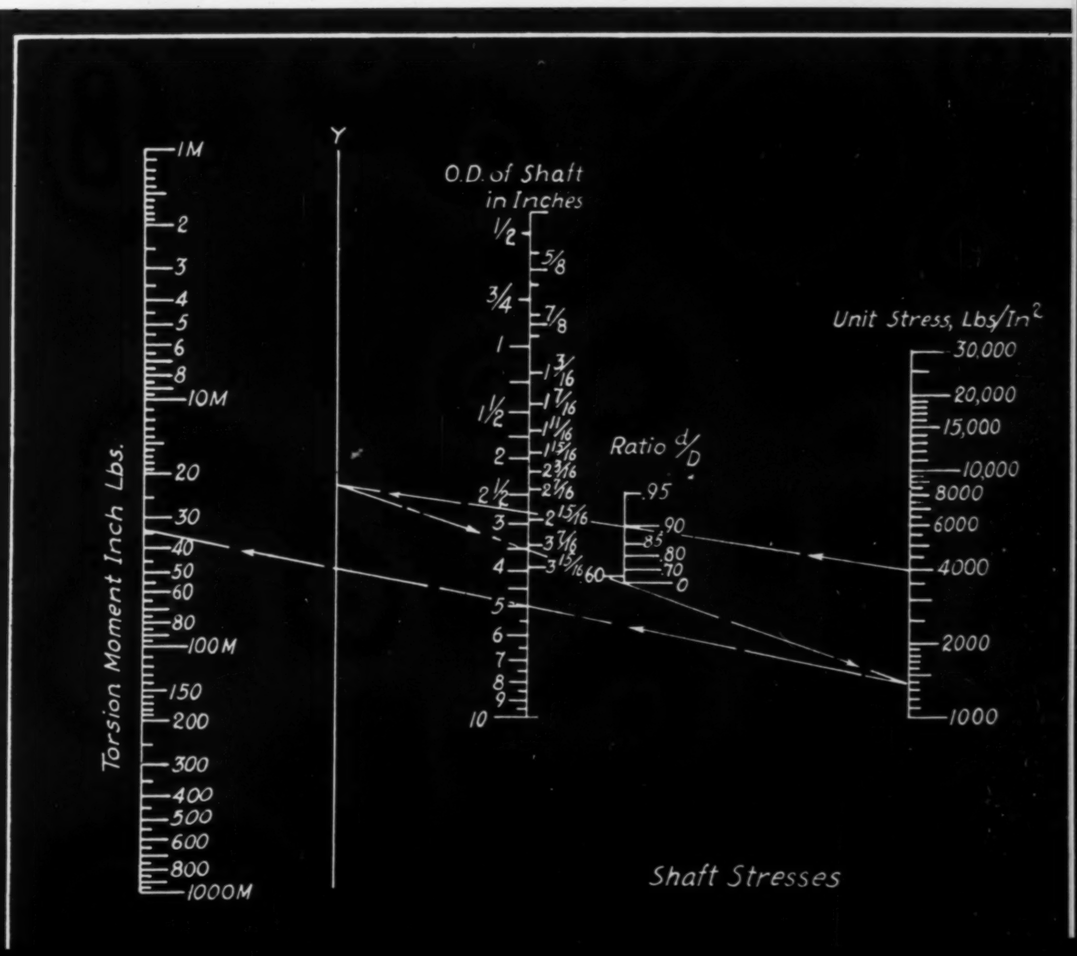
It is well known that making a hole in a given diametered shaft as large as half the diameter reduces strength only about 3 per cent while reducing the weight 25 per cent. Shafts with holes which have a ratio of d/D of less than 0.50 are substantially as strong as the solid shaft.

In computing the twist angle, the modulus of torsional elasticity was taken at 12 million. Any other modulus may be used by correcting correspondingly, as the twist angle is inversely proportional to the modulus of torsion. In order to get a common basis of comparison for twist angles, the length was taken at 100 inches, any other twist angle for other lengths will be in direct proportion to 100 inches.

On each nomograph an example is solved by the lines shown, as a guide, the examples being sufficiently obvious. It is usually best to start out from a given stress or twist angle for a definite torsion moment and then vary the shaft diameters or ratio d/D.


Angle of Twist in 100 Inches
30°
20
15
10°
8
6
4
3
2
1
.8
.6
.5
.4
.3
.2
.1°
O.D. of Shaft
15/16
1 3/16
1 7/16
1 11/16
1 15/16
2 3/16
2 11/16
3 7/16
3 15/16
1
1 1/2
2
3
4
5
6
7
8
9
10
12
14
16
18
20
Ratio d/D
.95
.90
.85
.70
.60
0
Y
Torsion Moment in Inch Lbs.
1M
2
3
4
6
8
10M
15
20
30
40
60
80
100M
150
200
300
400
600
800
1000M
2000
3000
4000
6000
8000
10,000M

Shaft Twist Angles


Torsion Moment Inch Lbs.
1M
2
3
4
5
6
8
10M
20
30
40
50
60
80
100M
150
200
300
400
500
600
800
1000M
Y
O.D. of Shaft in Inches
1/2
5/8
3/4
7/8
1
1 3/16
1 7/16
1 1/2
1 11/16
2
1 15/16
2 3/16
2 1/2
2 7/16
2 15/16
3
3 7/16
4
3 15/16
5
6
7
8
9
10
Ratio d/D
.95
.90
.85
.80
.70
.60
0
Unit Stress, Lbs/In²
30,000
20,000
15,000
10,000
8000
6000
4000
2000
1000

Shaft Stresses

Why Neglect Safety?

By J. C. Henny

Manager, Production Division, Hyatt Roller Bearing Co.

SUPERVISORS are putting forward a genuine effort to make the factory a safe and profitable place in which to work. Considerable advances are being effected, but there is one angle of accident prevention that is not making the progress that it should. Safety deserves more thought in the original design of machinery. Proper consideration of this phase of safety work would contribute very materially toward reducing industrial accidents. More general recognition of this problem and greater co-operation by machine users and machine builders will aid in bringing about the necessary improvement.

Supervisor Must Check

In all educational work concerning safety, the necessity of the supervisor checking and making sure personally that a piece of equipment is safe before turning it over to his employes is stressed. Foremanship of today demands that no wide-awake foreman neglect to examine thoroughly every new piece of equipment that comes into his department and check carefully in actual operation all working parts of the machine before it begins production.

A determined effort to design and build equipment to guarantee safe operation would eliminate this necessity for a check on the part of manufacturing executives and would prevent numerous accidents. As it now stands, the burden of responsibility for safe operation rests with the manufacturer who uses the equipment rather than with the builder of the equipment, the logical place for such responsibility.

Consider Proper Ventilation!

Proper ventilation of interiors and the trapping of lubricant and cutting compound are outstanding factors which have been given very little attention in the design of machine tools and equipment. The supervisor, therefore, is obliged to hold up the operation of equipment and recommend guards in unguarded positions, ventilation installation and special devices to prevent floor splashing and slipping hazards. Even on such well known hazardous machines as punch presses it is practically always necessary to order equipment from outside suppliers, who, because of the need built up by this neglect, have established an independent business in the manufacture of such articles. In other cases it is necessary to develop and build equipment for attaching to the machine in order to eliminate the hazard. If the machine builders were to co-operate with the manufacturers using the machine by obtaining from them a list of every device of this nature which is found necessary before the machine can be operated safely and then design their machines to overcome the necessity for these additions, present unsatisfactory conditions would be greatly mitigated.

While this practice would undoubtedly increase the cost of the machine it would be well worthwhile. The cost of building safeguards into the machine would be far less than the present practice of designing and building special equipment for the machine or purchasing equipment from manufacturers who make up the special devices.

Automobiles Constantly Improved

When we compare the automobile with industrial mechanical equipment, it is very apparent that the automobile engineers recognize and apply the principle of safety in design to their machines. Consequently, the automobile is being constantly improved to make cars safer to operate.

There is urgent need of co-operation in safety matters between the machine builder and the machine user. Even with such co-operation this subject is sufficiently important to warrant it receiving attention by legislators in the various states. The employe should be safeguarded by having laws enacted which require that all mechanical equipment pass proper safety requirements before it is presented for sale.

"In short, the greatest good to the greatest number of our employes makes it imperative that we operate our offices economically. We therefore, this year are spending as much, if not more time, thought and money on office machines than ever before. This applies not only to new machine development, but to bringing our present equipment into the best possible condition, and to a constant program of replacing worn-out or obsolete equipment."—G. L. Harris, Westinghouse Electric & Mfg. Co.

Centralized Systems Answer Lubrication Needs

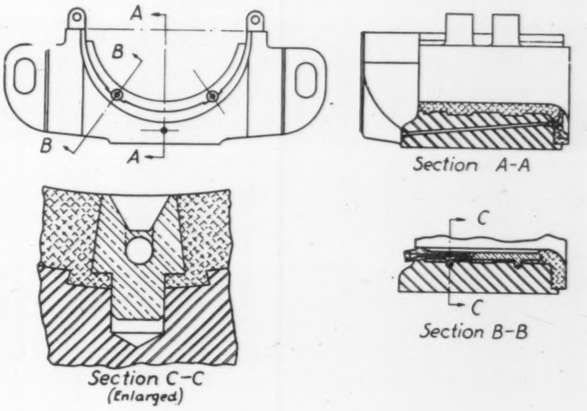


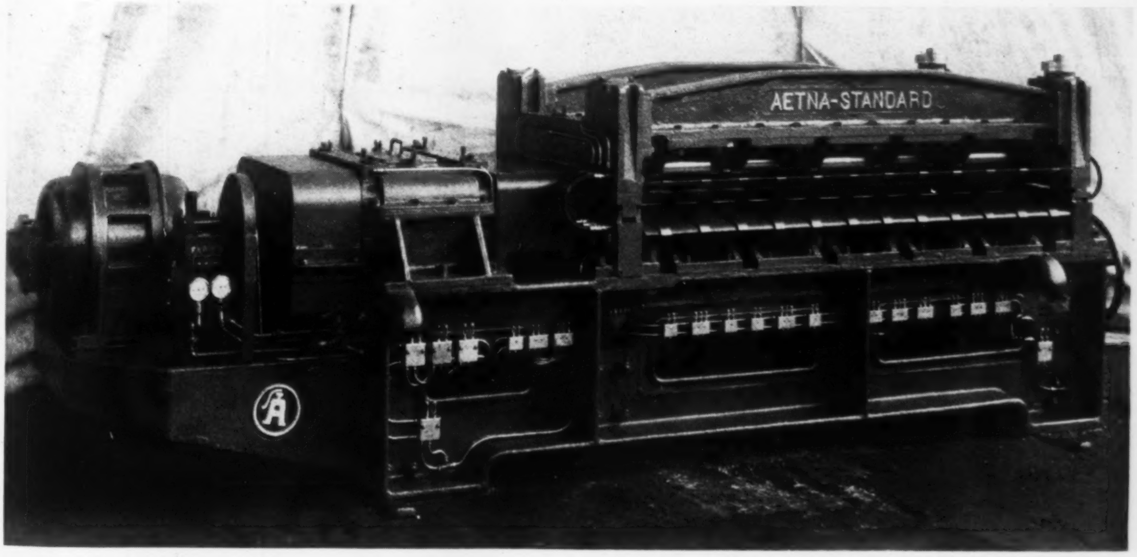
Fig. 1 — (Above) — Brass grids are employed for radial grooves of bearing Chuck is drilled to supply thrust surface with lubricant

BECAUSE lubrication problems are common to all machines and in many respects related, accomplishments in one field often can be applied to another. Therefore, from this standpoint alone, the discussions presented to the lubrication engineering division at the recent meeting of the Association of Iron and Steel Electrical Engineers are noteworthy. Particular attention is drawn to the details on centralized lubrication offered by A. J. Jennings, Farval Corp., Cleveland. He branded the hit and miss method of lubrication as unreliable, resulting in a feast or a famine for all bearings— with some being missed entirely.

A modern centralized system of lubrication, Mr. Jennings declared, will prevent frequent repairs due to inadequate lubrication. Waste and increased friction also will be eliminated by providing the positive delivery of a measured charge of lubricant to a group of bearings from a central point, entirely independent of the judgment of the oiler or his ability to reach all bearings regularly.

On structural and rail mills, billet and bar mills, the centralized system which delivers grease directly to the thrust collars has greatly increased the life of bearings in these units. On some installations bearing life has been lengthened by more than 600 per cent, he declared. In the case of an 18-inch sheet bar mill, centralized lubrication practically has eliminated all rejections due to off-gage rolling, and this item alone has paid the cost of the installation many times. Additional

Fig. 2 — (Below) — Centralized lubrication system installed on sheet roller leveller as an integral part of the unit



economies resulting from the use of the centralized system on this unit were outlined as follows: Reduced power consumption 30 per cent; increased life of bearings 1200 per cent; increased tonnage per bearing change from an average of 12,000 tons to more than 150,000 tons.

On the antifriction type of roll neck bearings and particularly on four-high mills, this method of lubrication rapidly is approaching a point where its adoption is becoming universal. By its use grease is maintained at the proper level and water and scale are kept out because the correct amount of grease brings into effect the full efficiency of the bearings seals.

Provides Safe Operation

One of the outstanding advantages of the system as pointed out by the speaker in reference to overhead traveling cranes is the safety it provides for one of the dangerous jobs in the mill. In addition the labor of oiling is reduced at least ninety per cent. In one place ten men were given thirty minutes to lubricate a large ladle crane and it was found actually impossible to cover all the bearings by hand in that period of time. With the centralized system one man can lubricate all the bearings of such a crane safely in less than five minutes.

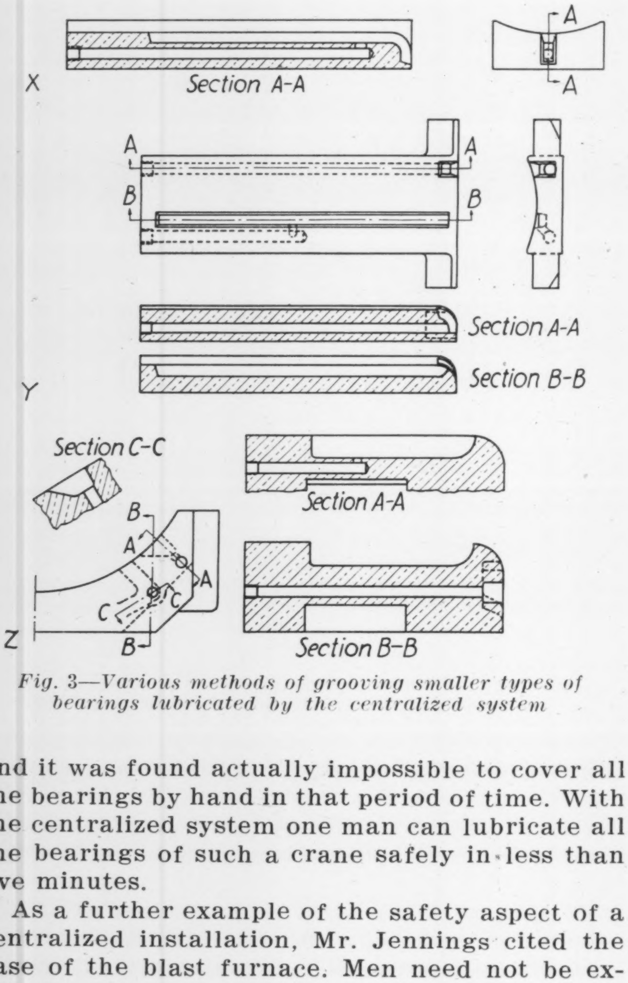


Fig. 3—Various methods of grooving smaller types of bearings lubricated by the centralized system

As a further example of the safety aspect of a centralized installation, Mr. Jennings cited the case of the blast furnace. Men need not be exposed to the danger of blast furnace gases when complete lubrication can be provided by one man from a convenient central point located on the stove platform.

In sheet mills the problem of drippage is reduced to a minimum because the accurate control over the amount delivered to each bearing leaves no excess to drop on the stock below. Lubrication of hot strip mill coilers is a difficult operation because it is next to impossible to lubricate them by hand while they are operating, and any serious trouble at the coilers holds up the entire mill.

Centralized System Specified

Indicative of the acceptance of this development is the fact that during the past several years many plants have included a specification to provide a centralized system of lubrication on all new equipment purchased, Mr. Jennings asserted. This type of system, as depicted in *Fig.* 2 which shows an installation of a sheet roller leveller, can be included readily in the original design.

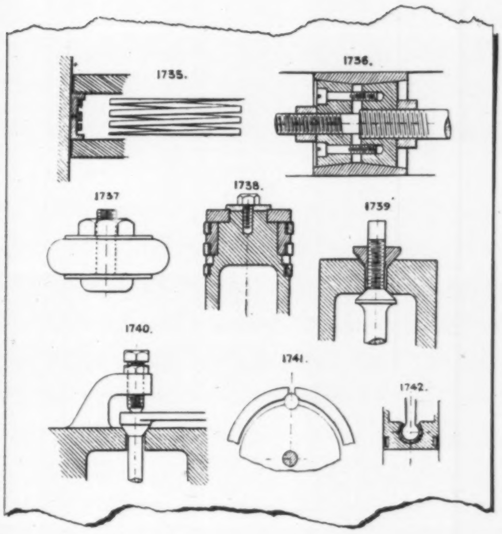
Methods for grooving bearings that have been used successfully for obtaining proper distribution of grease with a centralized system of lubrication, are shown in *Figs.* 1 and 3. The former illustration portrays the bottom bearing of a blooming mill where brass grids have been employed for the radial grooves and a lead drilled in through the chuck to supply the thrust surface with lubricant.

Section *X* in *Fig.* 3 shows a bearing having a small thrust surface and illustrates one groove leading to both the radial and thrust areas. The bearing shown at *Y* represents the type of grooving that has proved successful for center roll bearings of three-high mills. It will be noted that there is a separate lead for the radial surface and for the thrust surface. At *Z, Fig.* 3, is another method of using two leads into the bearing, both of which are at one side of the structure. Similar grooves and holes are located on the other side of the bearing to permit its use on either side of the mill. Taper on the groove provides a radius, eliminating all sharp edges.

Extra Film Strength Added

Forced feed lubrication now is recognized as the most efficient method of bearing and gear lubrication in the steel industry. This fact was revealed by Maurice Reswick, Standard Oil Co. of New Jersey, in his discussion of factors affecting the circulation of oil. Referring to extreme pressure lubricants, he explained that extra film strength is imparted to oils by the addition of certain compounds. What is gained thus in increased film strength, however, usually is at the expense of some other properties of the oil, Mr. Reswick asserted. When mechanical design and operating pressures are such that the use of an extreme pressure lubricant is advisable or imperative, the limitations of the lubricant should be recognized and precautions should be taken accordingly.

An Idea Book for Designers



Portion of typical page from Engineer's Sketch Book which shows stuffing box designs

The Engineer's Sketch Book

By Thomas W. Barber; published by E. & F. N. Spon, London; distributed in this country by Engineers Book Shop, New York; available through MACHINE DESIGN *for $4.50 plus 15 cents postage.*

To strive for originality in designing machinery is the precept of every conscientious engineer. Yet there are times when his store of ideas becomes exhausted, in which case such a reference work as *The Engineer's Sketch Book* becomes an invaluable aid. Mr. Barber in twenty-five years of designing found a genuine need for this type of compilation. He endeavored to overcome the deficiency in his own practice by private notes and sketches gathered promiscuously. When the difficulty of selection and arrangement became apparent he began to classify them; hence the inception of the present volume.

Nearly 3000 sketches supplemented by brief notes make up the 355 pages of the book. Examination of a portion of a typical page on stuffing boxes, which accompanies this review, discloses the purpose which it serves. The book may well be called an idea thesaurus to which the man engaged in designing a new machine or mechanism may go to augment his plan of carrying out a certain type of movement or operation.

This is one of the few compilations wherein an attempt has been made to provide side by side suggestive sketches of the various methods used for accomplishing any particular mechanical movement or work in a form easily referred to and devoid of detail and elaboration.

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Applied Hydro and Aeromechanics

By O. G. Tietjens; published by McGraw-Hill Book Co. Inc., New York; available through MACHINE DESIGN *for $4.00 plus 15 cents postage.*

Like its companion volume, *Fundamentals of Hydro and Aeromechanics* (M. D. Aug.), this book is one of the Engineering Societies Monograph series. In it the author has attempted to present the more important subjects of the wide field of fluid mechanics in a strictly scientific manner, avoiding a maze of pure mathematical formulas by emphasizing the technical rather than the mathematical treatment.

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Machine Drawing

By Eliot F. Tozer and Harry A. Rising; published by McGraw-Hill Book Co., New York; available through MACHINE DESIGN *for $3.00 plus 15 cents postage.*

A worthwhile beginning in machine design is accessible to the reader of this book which progressively develops problems tracing the production of a machine from the conception of the idea to the finished product. In this way the authors step beyond the usual scope of drawing treatises by indicating the basis behind the drawings and carrying them to their practical conclusion as reliable guides to machine manufacture. Problems are presented as they would come up in the commercial drafting room, with the recently adopted base hole system of dimensioning used throughout.

In addition to the basic principles of machine drawing, logically considered in chapters each presenting the various aspects of different types of parts such as bearings, clutches, cams, etc., the book gives the reader the methods of machine construction, general drafting room practice, materials of production, and a comprehensive treatment of machine sketching.

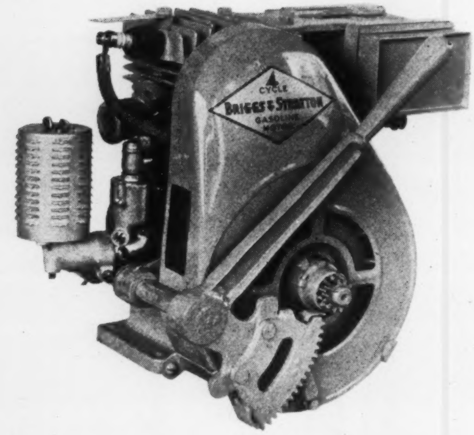


Fig. 1 — (Right) — The decalcomania that graces this gasoline motor is equal to the rugged service to which such equipment is subjected

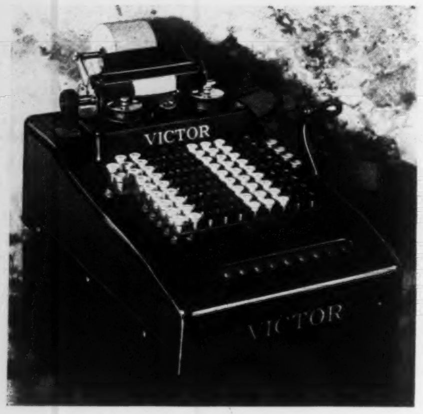
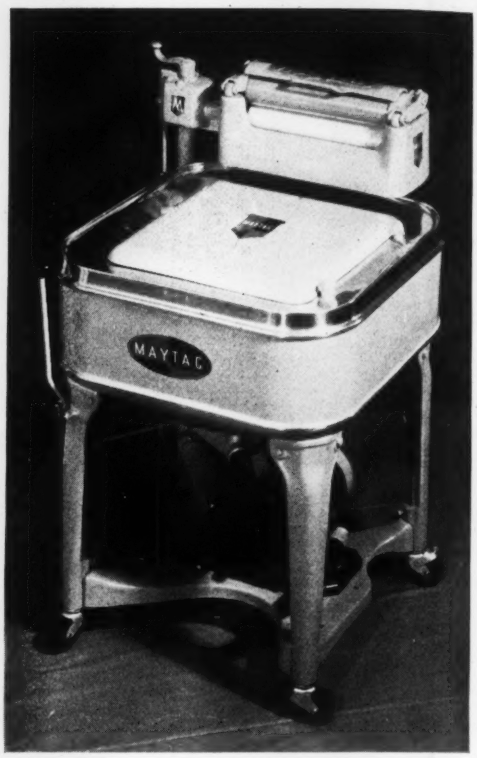


Fig 2 — (Left) — Varnish type transfers meet the requirements of open lettering such as found on this adding machine. Fig. 3— (Right)—A washing machine on which a decalcomania provides an attractive and effective trademark



Trend Is Toward Decalcomanias for Nameplates

By Harold B. Veith

SEVERAL major considerations face the engineering department in the matter of choosing a nameplate, trademark, instruction chart or other designation to be placed on the finished machine. One is the ease and dispatch with which it can be applied and how this operation will fit into the production schedule. Other factors are appearance and effectiveness.

Because decalcomania transfers meet these requirements various machinery manufacturers are adopting them to bring to the attention of the buyer and user an attractive nameplate, as well as various other data pertaining to the make of machine. The transfer process also is being employed to provide plates to indicate for example the proper oil level which should be maintained, cleaning instructions, etc. The "Patents Pending" label that is commonly seen is another use of the decalcomania.

Perhaps the most popular transfer is the water type shown on the washer and the engine in *Figs.* 1 and 3. This kind of transfer lends itself to high production schedules. The operator who applies them usually at the end of the assembly line, need only dip this transfer in water, allowing it to remain about 30 seconds. This loosens the transfer from the paper to which it is attached. Subsequently he slides the transfer off face up, onto the surface of the machine. Once in the desired location, the transfer is pressed down with a blotter, soft cloth or dampened felt roller and allowed to dry. Thus the operation is completed.

On heavy equipment where service is more rugged and on machinery that is exposed to the elements a differently constructed decalcomania transfer, of the varnish type, is recommended. This type also is advisable when the trademark consists of open lettering such as that on the adding machine shown in *Fig.* 2. To apply the transfer a thin coating of special cement is spread on the color side of the sheet. If the special cement is not available a good quality of quick-drying varnish, thinned with turpentine, will serve the purpose.

Method of Applying Transfer Is Simple

After allowing the transfer to stand until the cement or varnish becomes sticky or tacky it is placed on the desired spot which previously has been wet slightly with a damp sponge. When the transfer is in position it is rolled with a soft rubber roller. The next step is to saturate the paper which covers the lettering or design. When the paper is saturated thoroughly it is pulled off and the transfer is washed to remove the gum deposit. Surplus cement is taken off the surface around the transfer with benzine. On white enamel or delicate colors kerosene is used. The transfer should be allowed to dry thoroughly at least twelve hours before covering with varnish. As an extra protection to intricate designs a double paper covering is used for another series of this type of decalcomania.

A third available transfer which also is known as a water type is intended for hard service in weather, etc., but differs from the foregoing in that under usual conditions no varnish is required in applying it. After the surface to which it is to be applied is cleansed with a damp cloth the transfer, which has been dipped in water a few seconds, is placed down in the same manner as the varnish type. The paper covering them is slid or peeled off, exposing the face of the design.

Decalcomanias rapidly are replacing the old type of nameplate which usually was fastened to the machine with screws. In many cases it looked like something the engineer forgot and placed it there as an afterthought. Then there is the long accepted "cast-in" trademark which has been the practice among the heavier machinery builders. This also is giving way to the decalcomania, particularly since it now is possible to obtain a transfer that will endure the severe treatment given such equipment.

Because the water-type transfer has been developed to the point where even it can handle reasonably open-letter work and since it does not require the time and care in application peculiar to the other types, there seems to be no doubt that it is the most desirable for all practical purposes. Any artistic design or color combination can be worked out in these decalcomanias.

Developments in Metallurgy Augur Well for Design

VIRTUALLY every important aspect of materials development was under authoritative observation at the recent National Metal Congress and Exposition in New York. In the following discussion a summary of some of the pertinent subjects considered in technical papers will be presented, advancement in metal technology having a tremendous influence on future design.

The contribution by H. D. Newell, Babcock & Wilcox Tube Co., covered the ductility of chromium nickel austentic steel at elevated temperature. He pointed out that high alloyed materials in this classification are more or less non-ductile under tensional deformation at temperatures between 1000 and 1800 degrees Fahr. This also is true of many lower alloy pearlitic steels and even open hearth iron at temperatures corresponding to their transformation to the gamma state. The data brought out that lack of ductility is associated with the austentic face-centered structure while the alpha iron or body-centered arrangement provides a high degree of ductility. Improvement in the elevated temperature ductility of austentic steels, within the temperature range studied, may be brought about by the addition of elements tending to form ferrite.

Physical properties of steel sheets for deep drawing are affected by several variables, according to Reid L. Kenyon, American Rolling Mill Co. Although grain size is one of these, composition, structure and thermal and mechanical treatment also are influential and at times may have a greater effect. Grain size affects the smoothness of the surface of the drawn sheet and if this is important the grains must not be too large. Coarse-grained material is somewhat softer and weaker but also has lower ductility than finer grained sheets.

Alluding to properties of some cast alloy steels, T. N. Armstrong, Norfolk Navy Yard, claimed that excellent mechanical properties can be obtained from cast steels comparatively low in alloy content providing the manganese content is above 1 per cent. Excellent results were procured from several copper bearing steels containing small quantities of other alloys. Nickel manganese steels showed most consistent results. Variations in carbon and alloy content do not appear to affect the properties of this class of steel as greatly as experienced with some other alloy steels. Mr. Armstrong explained. Highest tensile strength for the quantities of carbon and alloys present was obtained in the nickel, manganese vanadium steels. The molybdenum steels revealed better resistance to impact than any of the high strength steels, and the copper steels possessed the best ductility in the original as-cast state.

> *DURING the past year the metallurgist has made pronounced advancement in his field, a significant step from the standpoint of the designer. Engineers in the mechanical profession depend on the National Metal Congress for an overall estimate of what has been accomplished.*

Gives Results of Peening

In discussing peening on physical properties of welds and stress relief, Prof. O. M. Harrelson asserted that a study of the summary of all his test data has revealed the fact that peening of welds relieves stresses and improves structures and all physical properties of the metals. If it were possible for the percentage of shrinkage of deposited metal to be reduced, the problem of high stresses would of course be solved. With this in view, a thorough investigation might be made to find some method of alloying the electrode metal to aid in the reduction of shrinkage.

Commenting on physical properties of case hardened steels, O. W. McMullan, Timken-Detroit Axle Co., presented test data in which he brought out that S.A.E. 6115, although the finest-grained steel of those examined, developed some of the lowest impact results. Carbon content of the case had but little effect on impact values. Case depth has the greatest influence on impact, the impact values decreasing with increase of case depth.

Rockwell hardness of case hardened parts is dependent upon the per cent of martensite in the case. High carbon content, high quenching temperatures such as pot quenching, and increasing alloy content raise the amount of austenite and lower the hardness readings. Decarburization during reheating also lowers the Rockwell hardness. Although low hardening temperatures give the highest Rockwell readings, higher hardening temperatures tend to give greater resistance to the file. This has been found to be a fact with plain carbon steel when water hardened.

Use of polarized light as applied to welding products, explained by E. W. P. Smith, Lincoln Electric Co., brought to attention the polariscope as one of the most convenient methods of determining stresses and their distribution. He outlined a plan for setting up one of these testing instruments and explained its use in detail. Information on how to make test specimens also was effectively presented.

Upon a basis explained by Mr. Smith, models of designs may be studied photoelectrically and the stress distribution analyzed. Following are a few simple suggestions made by the speaker as helpful in laying out the preliminary design. There must be no abrupt interruption of the surfaces of the stress carrying members. The smoother the surface the lower the ratio of maximum to average stress. The section may be viewed as a flume, carrying water. Wherever turbulence occurs will be stress concentration.

Study Welded Stainless Steel

Co-authors of the paper on corrosion-fatigue study of welded 18-8 stainless steel pictured to their audience an alloy steel with a static tensile strength of about 250,000 pounds per square inch which would have a fatigue limit in air of about 110,000 pounds. If this fatiguing action were accompanied simultaneously by a corrosion effect in ordinary carbonate water the fatigue limit would be lowered to a value somewhere between 10,000 and 25,000 pounds per square inch.

Instead of the 35 to 50 per cent of the static tensile strength to use as a design value the engineer is forced to design with a corrosion-fatigue limit which is approximately 4 to 10 per cent of the static tensile strength of the material. There is little wonder the authors say, that such a dangerous problem has attracted the attention of many investigators in the past five or six years. It is a problem which will demand more and more investigation to obtain the full picture.

New Machines Indicate Design Trends

BUILDERS of movable equipment designed to be operated out of doors, for years depended on efficient gasoline engines for their motive power. However, as these machines have grown more complicated, the designer has been faced with the necessity of devising complicated linkages and other mechanisms in order to connect the various motions to the prime mover.

The necessity for such mechanisms can be eliminated and appearance improved, as shown by the new finisher of Jaeger Machine Co. illustrated on the following pages. In this machine the standard gasoline engine has been replaced by gas-electric power, the engine and generator producing current for three electric motors located at different points on the machine. Thus an electric cable replaces complicated mechanisms.

Machines recently announced in addition to those on the next two pages include the following, arranged by fields of application:

Air Conditioning

Portable Ventilator,
Coppus Engineering Corp.,
Worcester, Mass.

Chemical

Solid Carbon Dioxide Press,
Baldwin-Southwark Corp.,
Philadelphia.

Air and Gas Drying Machine,
Pittsburgh Lectrodryer Co.,
Pittsburgh.

Construction

Leaning Wheel Grader,
Galion Iron Works & Mfg. Co.,
Galion, O.

Scraper,
LeTourneau,
Stockton, Calif.

Electro-Magnetic Vibrator,
Syntron Co.,
Pittsburgh.

Conveying

Belt Conveyor,
Northern Conveyor Co.,
Janesville, Wis.

Dairy

Two-Stage Homogenizer,
Manton-Gaulin Mfg. Co.,
St. Johnsbury, Vt.

Domestic

Food Mixer,
Hamilton Beach Mfg. Co.,
Racine, Wis.

Vacuum Cleaner,
P. A. Geier Co.,
Cleveland.

Washing Machine,
Getz Power Washer Co.,
Moline, Ill.

Electric Refrigerator,
Stewart-Warner Corp.,
Chicago.

Ironer,
General Electric Co.,
Bridgeport, Conn.

Ironer,
Scott Mfg. Co.,
Philadelphia.

Electrical Machinery

Generating Sets,
Cummins Engine Co.,
Columbus, Ind.

Finishing

Baking and Drying Oven,
Ajax Electrothermic Corp.,
Trenton, N. J.

Foundry

Ladles,
Modern Equipment Co.,
Port Washington, Wis.

Industrial

Unit Heaters,
Fedders Mfg. Co.,
Buffalo, N. Y.

Vacuum Cleaning Machine,
Kent Co. Inc.,
Rome, N. Y.

Metalworking

Plain Automatic Milling Machine,
Cincinnati Milling Machine Co.,
Cincinnati.

Universal Turret Lathe,
Jones & Lamson Machine Co.,
Springfield, Vt.

Long Stroke Drawing Press,
Hydraulic Press Mfg. Co.,
Mt. Gilead, O.

Die Duplicating Machine,
George Gorton Machine Co.,
Racine, Wis.

Lapping Machine,
Porter-Cable Machine Co.,
Syracuse, N. Y.

Portable Grinder,
United States Electrical Tool Co.,
Cincinnati.

Paper

Rotary Knife Cutter,
Sprout, Waldron & Co.,
Muncy, Pa.

Power

Variable Engine Eccentric,
Troy Engine & Machine Co.,
Troy, N. Y.

Printing

Tag Embossing Machine,
Pannier Bros. Stamp Co.,
Pittsburgh.

Railway

Electric Car Spotter,
Link-Belt Co.,
Chicago.

Refrigeration

Ice Making Machine,
Carbondale Machine Co.,
Carbondale, Pa.

Textile

Continuous Wool Goods Washer,
Riggs & Lombard Inc.,
Lowell, Mass.

Waterworks

Chlorine Feeder,
Proportioneers Inc.,
Providence, R. I.

Welding and Cutting

Portable Arc-Welding Set,
General Electric Co.,
Schenectady, N. Y.

Oxyacetylene Cutting Machine,
Air Reduction Sales Co.,
New York.

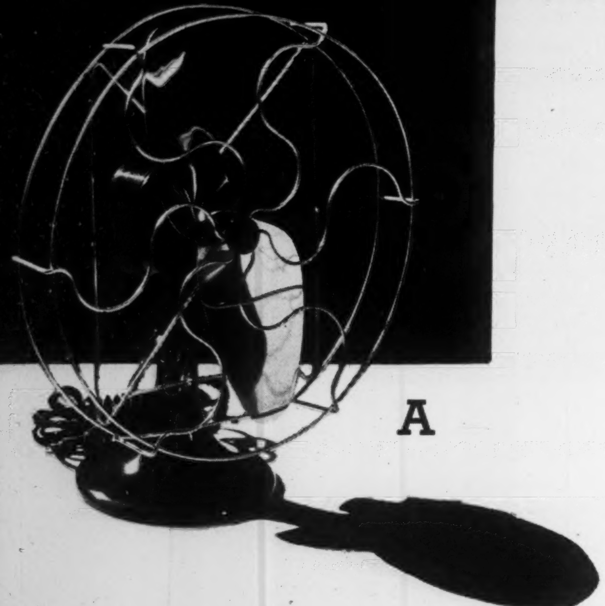
Wire

Upright Cone Wire Drawing Machine,
Waterbury Farrel Foundry & Machine Co.,
Waterbury, Conn.

Woodworking

Routing Machine,
Onsrud Machine Works,
Chicago.

Portable Electric Rotary Planer,
Black & Decker Mfg. Co.,
Towson, Md.



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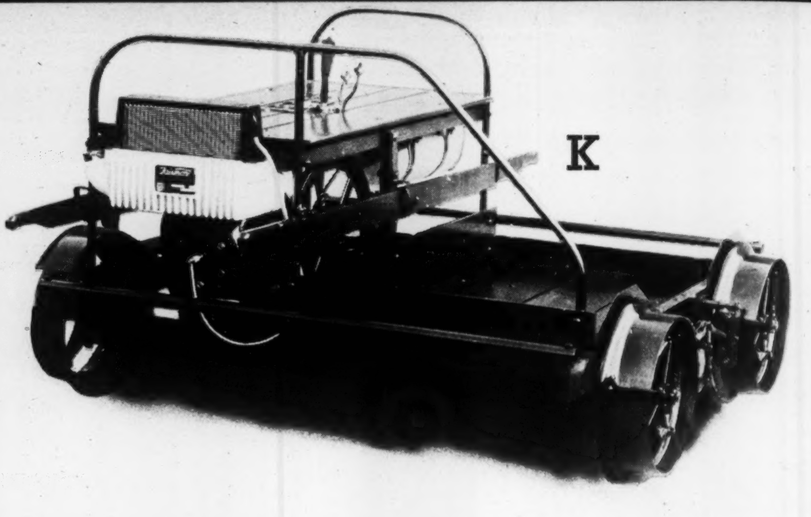

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Design Features in New Machines

A Pictorial Presentation of Recent Machinery from the Standpoint of Design.

(A) Borrowing from the airplane industry, the fans of Barber-Colman Co. have two aluminum blades wide at the base and narrowing at the tip which deliver more air than former four-bladed models. A special motor is mounted in a bakelite case selected for appearance, lightness and lower electrical losses.

(B) Discoloration from cutting oils cannot be detected on the new tapping machine of R. G. Haskins Co. This machine is of a chocolate brown color with a crystalline finish which absorbs or hides the glossy appearance of the oil. Two vertical shafts slide in long bearings, line reamed and lapped to insure alignment of the tapping head.

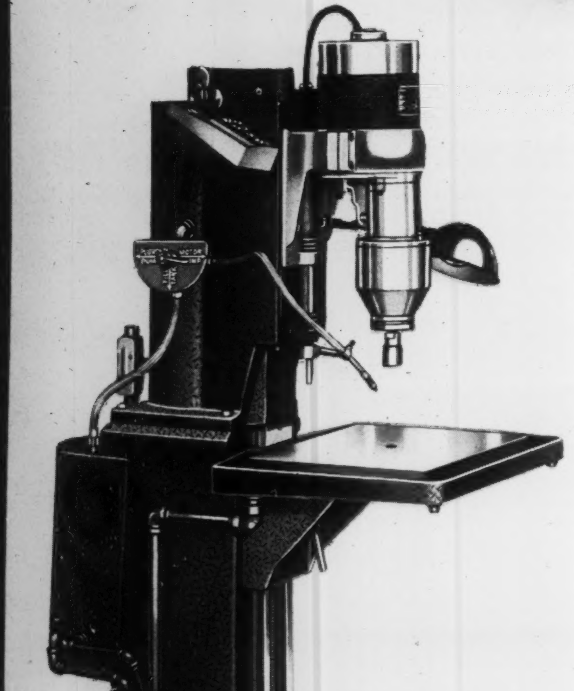
(C) All bearings, shafts and gears are enclosed in oiltight, dustproof cases and operate in a bath of oil on this track type coal saw. Power is applied to the saw chain through a special multiple disk-type clutch to prevent the imposition of excessive load. Two speed propulsion is obtained through multiple disk traming clutches with four-wheel drive. The saw is built by Sullivan Machinery Co.

(D) Styled to correspond with the needs of the home, the Micro Corp. oil burner obviates vibration primarily by accuracy of manufacture. Motor is of the flange typ rigi chined surface. Pump is conne by flexible couplings.

(E) Double equalizing connect motion have been employed and smoother motion of the scr machine built by Jaeger Machine rods eliminate radial swing. A is the use of built-in differential the machine can be steered arou perfectly aligned.

(F) An oscillating motion is in sander of Sterling Products moves back and forth with the san sanding. The motor is sealed in protecting it from dust and wate of specially impregnated rubber

(G) Protected by a safety dev impossible for the operator the Wrapade Machine Co. power cellophane is arranged so that he adjusted. As the pressure is a it is possible to apply the correc of pressure for each bag.



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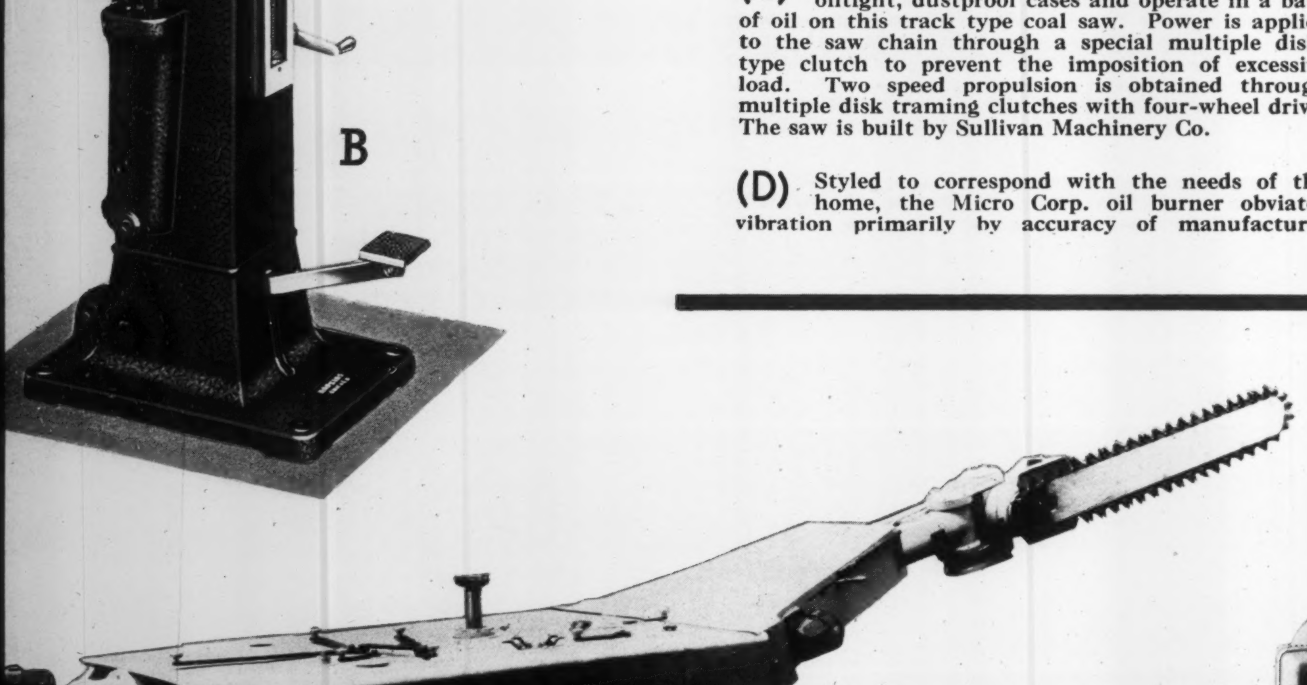

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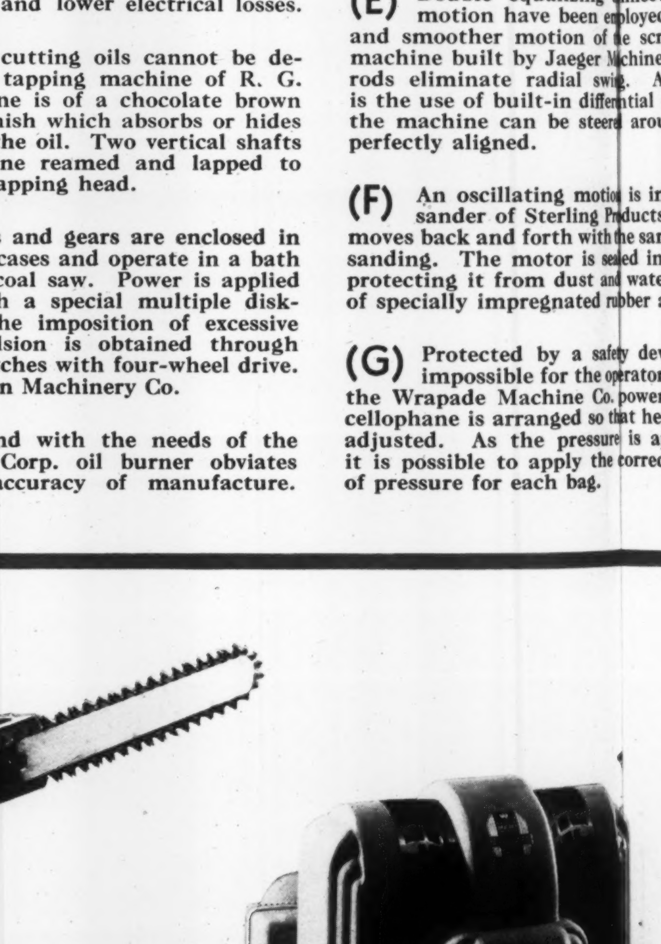

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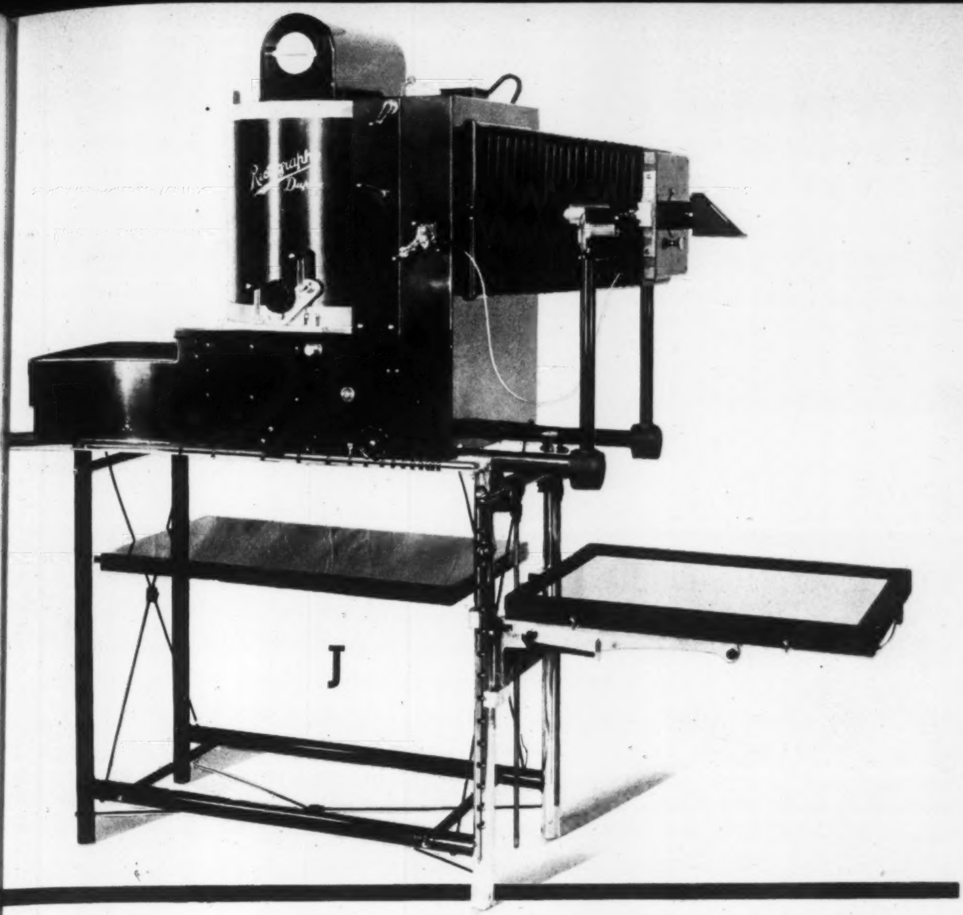
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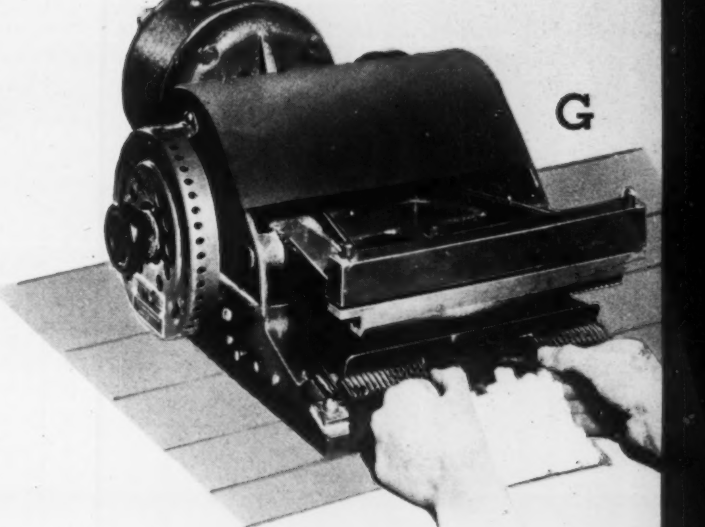
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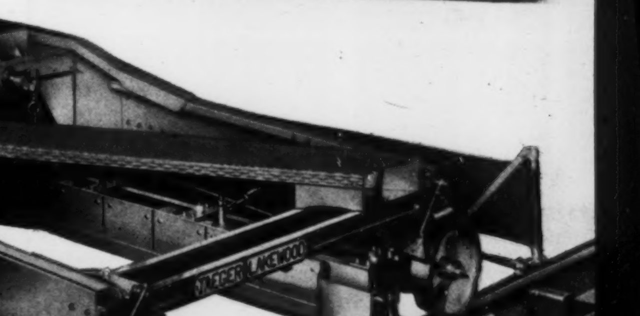
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n differential and brakes by which
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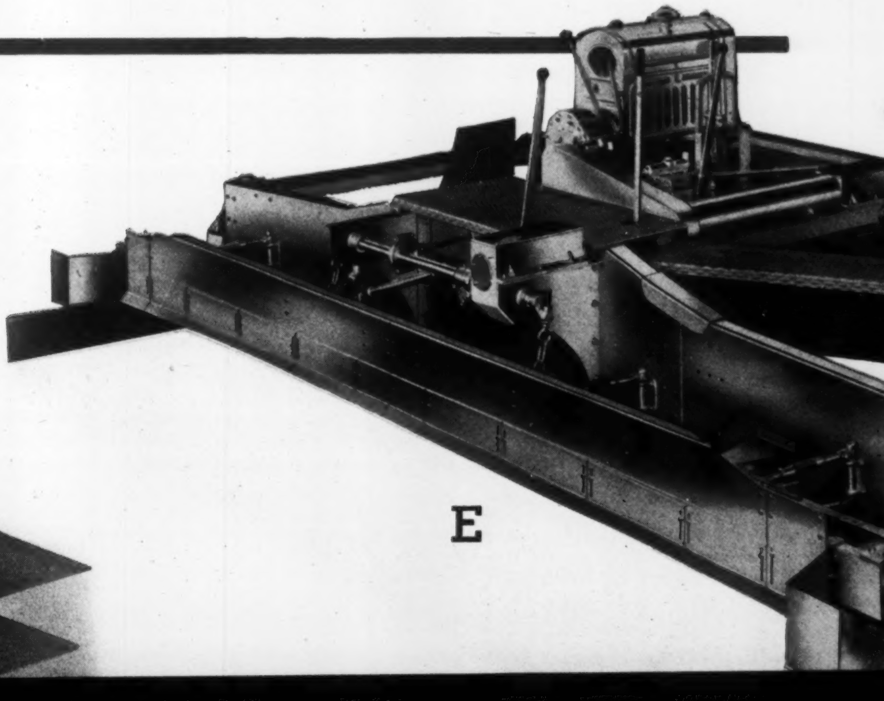
ling Products Co. so that the pad
n with the same motion as in hand
r is sealed in an aluminum case,
ust and water. The pad is made
ated rubber and felt.

a safety device which makes it
the operator to crush her fingers,
ne Co. power crimper for sealing
d so that heat may be accurately
ressure is applied mechanically,
y the correct and same amount
bag.

(H) A fan or blower, rustproofed and designed for maximum air supply and noiseless operation provides the air on this Kelvinator boiler-burner unit. All excess parts have been eliminated in the trim assembly design which makes use of welded steel construction enhanced by polished chromium corners. A direct connected motor and noiseless, self-priming pump are employed.

(J) At every point where metal might possibly come in contact with chemical solutions in this photo-copying machine, nickel castings are used. The machine is of all-metal construction, mounted on a tubular metal frame reinforced to give rigidity. The unit, built by Rectigraph Co., will reproduce both sides of a subject on a single sheet without the use of a dark room.

(K) All weight centers well between the wheels of the rail car of Fairmont Railway Motors Inc. as both rear wheels are driven. A flanged pulley containing two grease-packed roller bearings presses lightly on the returning half of the endless cord drive belt. A spring maintains smooth pressure. Four aluminum wheel guards, running board and inner tray insure safety. Axle flexing or fatigue is prevented by a steady bearing.



E

MACHINE DESIGN

Breadth of Experience Determines Capacity To Accept Opportunities

DESIRABILITY of possessing broad training and experience has been consistently urged in MACHINE DESIGN. Recently an incident occurred which aptly illustrates this point. A technical research engineer who had worked in a specific line had occasion to meet a group of men engaged in several phases of industry. Conversation was brisk and touched on subjects such as management, finance and the labor situation. The research man obviously was out of place and retreated from the group as quickly as conditions would permit.

Tackled diplomatically later he frankly admitted that he was embarrassed by the discussions of the others. He had specialized to such an extent that he was unable to speak their language! Yet it never had seemed evident to him before, in similar situations, that his narrow training had fitted him excellently for a particular "niche" but served drastically to retard him in general progress.

Such occasions—and later realizations—are not by any means rare. Talking is not doing, yet too few engineers appreciate the value of their having a breadth of training that facilitates their participation in discussions of almost any type of industrial group. Specialization has its place, but in times like these it is not the engineer who possesses the greatest knowledge, but rather the widest, who usually is the man most sought.

• • •

Single or Combined Effort?

POOLING of ideas gains another point! This system has been practiced in the automotive and to a lesser extent in the aircraft industries for many years. Now another branch of transportation—street railways—takes a leaf from the book and forges ahead. At the recent exposition of the American Transit association new streamlined street cars were exhibited that unquestionably will do much to re-establish surface lines.

Primary among the factors responsible for the newly-designed cars is the electric railway presidents' conference committee. This was inaugurated under the leadership of Dr. C. F. Hirschfeld of Detroit to carry out a program of research and development aiming to improve electric railway equipment. Remarkable results have accrued from the collective effort. Custom and tradition that ordinarily might restrict the designer and staffs of single companies have been cast aside by the combined group. Much can be learned from a study of this method of design approach; it would apply to many other lines facing competition from without.

PROFESSIONAL VIEWPOINTS

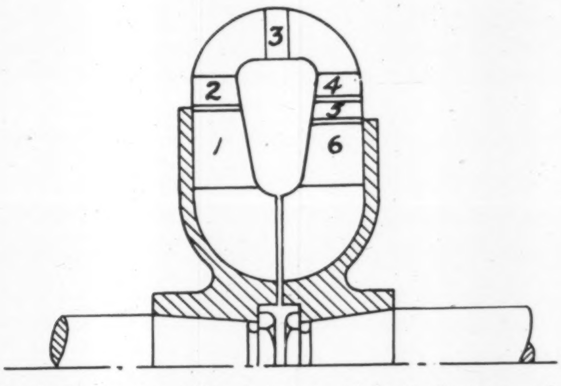
Machine Design Welcomes Letters Suitable for Publication

Hydraulic Clutch Has Limitations

To the Editor:

THE points brought out by H. W. Hamm in your September issue regarding the inability of obtaining increased torque at low speed by the use of Radcliff-type clutch, as well as the Eaton type illustrated in your April issue, are entirely correct. Hence the term "clutch" instead of "transmission" which as in a mechanical unit increases its torque output in inverse ratio to the speed.

The possible misunderstanding seems to have come about due to there being no description or illustration in the April article of the Leyland (Lysholm-Smith built) torque converter which is built under the patents of the Ljunstrom Steam Turbine Co., of Stockholm, Sweden. This converter differs from hydraulic clutches in that two rings of stationary guide blades are used which furnish the necessary reactance points for torque multiplication.



Guide blades furnish reactance points for torque multiplication in torque converter

As shown in the accompanying illustration, in the Leyland torque converter the single ring of impeller blades 1 is driven by the engine and the working fluid is forced radially outward to the rings 2 carried (by means not shown) by the turbine wheel of the driven shaft. The fluid then passes through the first row of stationary blades 3 which reverse the rotational component of flow and deliver the fluid to the second ring of turbine blades 4. A stationary ring of blades 5 next comes in the closed circuit which finally passes through the last ring of turbine blades 6.

A trial installation is undergoing test in bus service operated by the International Railway Co., of Buffalo, N. Y.

—AUSTIN M. WOLF,
New York

Thread Representation Confusing

To the Editor:

STANDARDIZATION of drafting room practice, discussed in your August issue, is certainly a long-felt need and many new suggestions will do a great deal to facilitate understanding. One point in your article attracted my attention particularly; namely, the suggestion pertaining to the way to represent screw threads.

The deviation from the natural lines as threads appear to the eye, substituting for the same by drawing two parallel lines as recommended for standard practice, is the style that makes the drawing hard to read for the average mechanic. While the purpose of the drawing is to convey clear understanding, this misrepresentation of natural appearance on the pretense of "saving" is working exactly the opposite by causing numerous mistakes and delays in the shop.

We have, for instance, keyways, oil groove, splines, and bushings where lines run naturally parallel, and in small designs even these crowd so badly that they are hard to distinguish. Why then shall we make two errors—deviate from the natural and crowd an already crowded drawing—in order to use a standard practice?

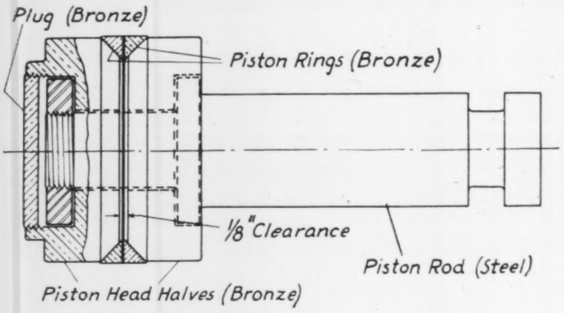
—J. MICHELSON,
Worcester, Mass.

Metallic Packing Eliminates Leaks

To the Editor:

A WATER pressure of 1500 pounds per square inch was used by a large concern on a hydraulic production butt-welder. The leather cups which were used as a packing on the pistons were a constant source of trouble. They wore out fast and often broke after only a few hours of operation, necessitating frequent shutdowns of the welding machine. A metallic packing was then designed by the author which stood up better in service than the leather cups.

The metallic packing, shown herewith, consists of two piston head halves with a slide fit on the stud of the piston and a loose fit in the cylinder. A plug in one of the heads prevents any water from passing along the piston rod stud. The piston halves are beveled to make room for the piston rings and effect their expansion when pressure is applied to either end of the piston head. The two piston rings are closely fitted into the cylinder which must have a perfectly round and smooth bore. Each ring is slotted once with a 1/32-inch thick saw. When assembling care must be taken that the slots are 180 degrees apart. To prevent wandering of the rings and meeting of the slots, the rings can be secured by small pins.



Piston halves are beveled to effect expansion of piston rings when pressure is applied

In operation, no trouble was encountered by excessive friction or wedging of the rings. Their narrowness (they were half an inch wide on a four-inch diameter piston) permitted them to wear in fast and keep a valve-seat-like fit in the cylinder; hardly any leak could be observed out of the drain pipe when full pressure was applied.

—Paul C. Bruhl,
Highland Park, Mich.

Do Tabulated Drawings Conserve Time?

To the Editor:

IN THE August issue of Machine Design you published an article entitled "Tabulated Drawings Conserve Time." My attention was attracted to this letter because of my experience with a company using these drawings where it was proved statistically that they caused an increase in cost amounting to 15 per cent.

The reason for such expense is as follows: It is much harder to read a drawing in the shop than in the drafting room, due to noise and poorer lighting, and when a man has to refer to a drawing several times, each time looking up a letter and dimension, he is very liable to make mistakes. Because of frequent use, drawings or prints get dirty, even when protected by a coating. Moreover, when it is necessary to revise a drawing it is difficult to collect all of the tabulated drawings and elaborate checking system is required to keep track of them.

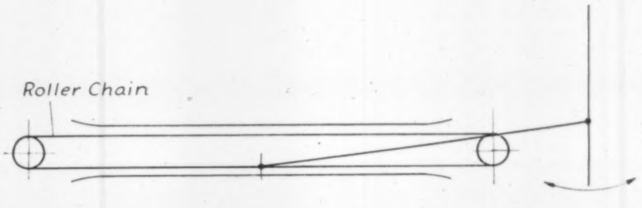
I believe that all engineering drafting and dimensioning should be done in the engineering department so that the man in the shop can get the proper dimensions without having to refer to different parts of the drawings or perform any calculations. This makes it possible for the shop to execute the design exactly according to specifications.

—Joseph C. Rah,
Chicago.

Obtaining Uniform Oscillatory Motion

To the Editor:

IN LINE with the many useful ideas I have obtained from your interesting magazine, I have the following to offer. We were in need of a long stroke, uniform velocity, oscillatory motion. The error of acceleration inherent in a simple crank was too great to contend with. Therefore we conceived the mechanism shown diagrammatically in the accompanying illustration. The device uses a pair of sprockets and connecting roller chain with a push pull rod fastened to one of the link pins. By using minimum diameter sprockets and simple guides for the chain to ride in, we have what we believe to be a rather useful rig in which we can easily vary the length of stroke as well as the frequency of the oscillations as required.



Roller chain assists in obtaining long stroke, uniform velocity, reciprocating motion

—C. Ludwig,
New York.

A Call for Service

... and another production problem solved!

ANOTHER BREAKDOWN! Another shutdown! Production tied up all along the line until the key part which failed could be replaced.

Then the chief engineer remembered the good reports he had heard about alloys containing nickel. Decided to let International Nickel's technical staff diagnose the case.

The Nickel Company cooperated. Here was their recommended composition, based on the exhaustive tests of their Research Laboratories. Here was the service data. Moreover, the alloy recommended was readily procurable from a nearby source—and the Nickel Company would cooperate in the treatment and fabrication.

So the problem was solved — a different metal was substituted for the composition which had failed, and similar breakdowns were eliminated.

* * * *

Every day, International Nickel's technical service is confronted with dozens of similar problems — problems relating to strength, toughness, wear, corrosion and heat effects—and is called into consultation by machinery manufacturers and machinery operators in all of the principal industries.

The accumulated results of years of experiments carried on in our Research Laboratories with alloys of nickel — wrought and cast steels, cast iron, bronzes, corrosion and heat-resistant alloys—and the wide experience of a technical sales organization operating in all industrial countries of the world, are constantly made available to industry, without obligation.

THE INTERNATIONAL NICKEL COMPANY, INC.
Miners, refiners and rollers of Nickel.
Sole producers of Monel Metal.
67 WALL STREET NEW YORK, N. Y.

ALLOYS CONTAINING NICKEL

TOPICS

A SURVEY to determine whether new mechanical developments in such fields as aircraft, air conditioning, television and fabricated houses will stimulate the machinery industry substantially and aid in the recovery from depression, has been launched by R. E. W. Harrison, chief of the machinery division, bureau of domestic and foreign commerce. According to Mr. Harrison, if American machinery production continues to rise no faster than it has since the first quarter of 1933, manufacturers of machinery must adjust their production capacity and their corporate and bonded indebtedness to the new and reduced levels. But if the levels of 1928 and 1929, to which industry is geared, are recouped, then no widespread reorganization will be needed.

* * *

A higher factor of safety will be built into racing planes of the future. This objective was expressed following the recent National Air Races. It will be recalled that Douglas Davis, one of the Thompson Trophy contenders, met death during the speed classics. New craft built to compete in the 1935 air races will be given proper structural analysis and inspected by a technical subcommittee appointed by the racing pilots themselves.

* * *

Comparison of the list of sizes of taper roller bearings which appeared in the original draft of simplified practice recommendation R67 (1927) and the revised recommendation approved last year and now available in printed form, shows the increasing use which industry has made of bearings of this type. The original list, largely for automotive use, ranged in bore size from 5/8 to 4 1/2 inches. While there were many sizes within these limits, differing by small fractions, the fact that the maximum size was 4 1/2 inches indicates that bearings of this type were limited in application.

Acting chairman of the ASA standing committee, E. Wooler, chief engineer of Timken Roller Bearing Co., advises that the steep angle bearings up to 12 inches bore, which were added in the revision, provide for naval requirements and for general industrial and automotive purposes. In addition to the steep angle taper bearings, conventional bearings are divided into three series, light, medium and heavy. In the light series the bore sizes range from 0.375 to 3.750 inches; in the medium series sizes range from 0.750 to 11 inches, and the heavy series range from 1 to 12 inches.

The list may be obtained from the Superintendent of Documents, government printing office, Washington, or American Standards association for five cents.

* * *

Some indication of the progress of the radio industry, in which design has played a major part, may be had from figures compiled in a recent survey. The United States has 18,500,000 sets of the estimated total of 42,540,239 radio receivers in operation throughout the world. There are 1497 medium wave broadcasters and 585 of these are located in this country. The figures recently were made public by Lawrence D. Batson of the electrical equipment division, department of commerce. Regional distribution of receiving sets in the world shows North America first with a total of 19,769,045 and Europe second with 18,594,605 sets.

* * *

Evidence of the co-operative spirit that characterizes America and particularly its engineers is found in a recent movement in which engineering societies offer help to engineers of the Soviet. According to *Industrial Standardization*, the American engineering societies including the American Standards association, officially are placing their services at the disposal of the Soviet Union to assist in its engineering progress. The program which is being offered includes: Aiding Soviet engineers who come to the United

The New Diehl "IN" Squirrel-cage Motor

THIS NEW DIEHL MOTOR HAS 41 POINTS OF EXCELLENCE

Forty-one major improvements make the Type "IN" motor what it is today . . . the result of nearly 50 years experience in motor design and application. The improvements in ventilation . . . insulation . . . bearings . . . electrical characteristics . . . and other features are worth looking into.

On machine tools, pumps, presses, blowers, hoists, conveyors and hundreds of other industrial applications Diehl Type "IN" squirrel-cage motors give the trouble-free service and low maintenance you have wanted for your equipment.

These motors are built in accordance with N.E.M.A. standards. Sizes from ¼ to 25 HP, equipped with either oil-ring sleeve bearings or ball bearings, are available for immediate shipment from nation-wide chain of warehouse stocks.

Diehl motors are used and recommended by leading machinery manufacturers and are backed by a half century Diehl reputation and a network of competent service stations all over the country. Diehl sales engineers will gladly assist you in selecting just the right motors for your particular requirements.

DIEHL
Type "IN" Squirrel-Cage Motors
General Purpose Constant Speed Continuous Duty

"TYPE IN" SQUIRREL-CAGE MOTORS

This new "IN" motor bulletin explaining the 41 points sent on request.

Write to Diehl Manufacturing Company, Elizabethport, New Jersey, or to District Offices in Atlanta, Boston, Chicago, Dallas, New York and Philadelphia.

DIEHL MOTORS

DIEHL MANUFACTURING COMPANY, Electrical Division of THE SINGER MANUFACTURING COMPANY

898A

States in search of engineering information, training, or to arrange for technical visits; exchange of engineering information between the two countries; placing operating American engineers at the service of the U. S. S. R.

The American engineering societies offered the aid of two members of the societies' crafts who speak technical Russian and have a wide knowledge of American industry, engineering and science. The facilities of the Engineering Societies building were placed at their disposal. First official conference between representatives of Russian and American engineers took place June 11.

* * *

A new type of microphone, hailed as an engineering achievement in radio broadcasting, was used for the first time in putting the America's cup races on the air. It is slightly larger than a baseball and is said to combine features of both the ribbon and the dynamic microphone. Because it is more sensitive, the audience gets more of the background "atmosphere" as well as more details due to the ability of the announcers to move the new compact equipment quickly to any part of the scene of action.

* * *

Significant reports recently made by the department of commerce include an announcement that Germany's purchases of foreign machinery during the first half of 1934 were greater than those of the corresponding periods of either 1932 or 1933. This prevailed in spite of the severe restrictions against its importation. German exports of machinery during the first six months were lower than for the two preceding years. Metalworking machinery, prime movers, compressors, fans, pumps, blowers, and crushing and ore processing equipment accounted for the increases in machinery imports during 1934.

* * *

Some idea of the endurance being designed into present days trucks may be obtained from a White unit that has traveled 700,000 miles. It was used by a large rubber company for continuous tire testing. The malleable castings employed for the spring shackle brackets went all the way without failure. Another instance to prove that modern materials also have kept pace with progress in design.

* * *

Considerable attention has been focused on the railroads recently. In reporting on activity in that field recently the *New York Times* has this to say: With the railroads casting in every direction for means of reducing expenses, some persons who have been studying the problem believe the executives of the carriers should give serious thought to purchasing more modern locomotives rather than spending huge sums on repairing existing engines. Joseph B. Eastman, federal co-ordinator of transportation, virtually suggested this in his recent report on locomotive repair costs and their relation to the age of the motive power inventory. In 1933 the locomotive repair expenses of the railroads aggregated $191,189,000, or approximately double the $95,726,000 paid out in dividends by the roads in that year.

* * *

Among automobile topics is the announcement of a new type of system known as "sealed cooling" now being installed on one of the prominent makes of automobiles. It is said to eliminate the need for the constant addition of water because its overflow pipe is closed, action being governed by a dual valve arrangement.

* * *

Steadily the electric eye forges ahead and acquires new applications, typical of which is its use in connection with a device that will make an automatic record of traffic conditions. It is being employed to record passing automobiles by actuating a camera shutter for a picture. Sixteen pictures a second may be taken if necessary.

* * *

As a monument to the ingenuity of the late Thomas A Edison a permanent exhibit is being arranged in a recently completed building linked with the laboratory in the Edison plant at West Orange, N. J. Models of many of his inventions as well as chronological wall charts showing his life and achievements will be included in the display.

* * *

Through philanthropic grants the American Foundation for the blind of New York has been able to employ engineers who have perfected a new typewriter for the blind—it writes Braille. The designing of this machine was a difficult task inasmuch as Braille is a type embossed on special paper. Instead of letters, dots are impressed by dies. There are no more than six dots, and these when properly combined and positioned, correspond with all the letters of the alphabet, numerals and punctuation marks. Early machines were large and clumsy.

ADVERTISEMENT—*Each item on this page is a paid advertisement*

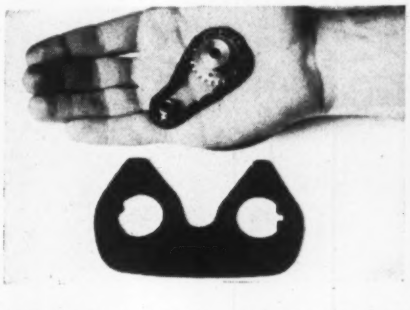
POWER TRANSMISSION NEWS

One of the few things which a giant ore unloader on a Great Lakes steamer and a motion picture projector have in common is an application of a Morse Silent Chain Drive.

The accompanying picture illustrates the wide range of Morse Silent Chain Drives, from $\frac{3}{16}$″ pitch, shown here with a link from a 3″ pitch by way of comparison.

The $\frac{3}{16}$″ pitch is widely used in units applying fractional horsepower, such as adding machines, motion picture projectors, sewing machines and other small devices.

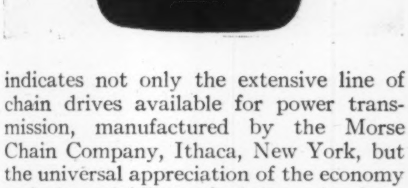
The fact that these drives range all the way up to 3″ pitch for the heaviest service indicates not only the extensive line of chain drives available for power transmission, manufactured by the Morse Chain Company, Ithaca, New York, but the universal appreciation of the economy and dependability of these units in a multitude of commercial and industrial applications.



200 Drives in One Plant

Apart from their definite economies of operation and savings in maintenance, Morse Chain Drives provide other advantages which we find are of considerable interest to engineers and production men.

Discussing the Morse Drives about 200 of them in his plant, one superintendent says: "The short centers permitted by chain drives save production space, and the absence of line shafting improves light and operating conditions. The chains are encased, eliminating one important accident hazard and their long life is unequalled by anything else we have ever used."



Spring Lock Pins a Feature of Morse Roller Chains

Recommended in place of cotter pins—will not shake loose, but are easily removed. Note the twist in the pin—it exerts a powerful holding influence against vibration and chain whip—guards against loss of side plates and chain breakage. Easy to insert, just push in place—the twist holds it tight.

Morse Silent Chains have an enviable record in the automotive industry as standard equipment. Several million cars are equipped with Morse Chains for timing gear drives, thus insuring silent, positive, carefree operation.

Thirteen years consistent use of Morse Chain Drives in a 4-million bushel capacity elevator, enables the mechanical superintendent to judge their value. "We find," he reports, "that Morse chains withstand better than any other type of drive the extremely damaging effects of the ever-present dust and grit."

Six Morse drives serve a variety of purposes in this elevator and Morse chains, ranging from 7½ to 100 horsepower, are used in other elevators operated by the company.

"Because they operate without slippage and at full efficiency," he concludes, "Morse chains are ideal for elevator service where space is always at a premium."

Chain Drives

FOR STEADY, POSITIVE OPERATION • Chain drives transfer power continuously, conserve power, increase output and reduce power and transmission costs. • Full engineering data is available on request, explaining this flexible, positive, low-cost method of power transmission. There is a Morse Drive scientifically engineered to meet your power transmission problem, large or small.

MORSE CHAIN COMPANY

A Division of Borg-Warner Corporation

ITHACA, NEW YORK

MEN OF MACHINES

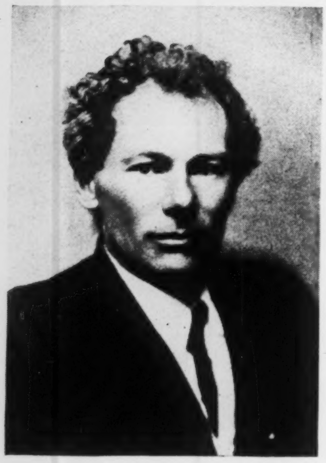
OUT of his hobby—the science of aeronautics and flying—William Edward Boeing has built an enviable reputation in the aircraft industry. Recently he was awarded the Daniel Guggenheim medal for successful pioneering and achievement in this field.

Mr. Boeing was born in Detroit, Oct. 1, 1881, received his schooling both in this country and in Switzerland and entered Yale in the class of 1904. Subsequently he went into the logging business but pursued his hobby of flying.

Oddly, an accident led to the Boeing company's establishment. His private seaplane was damaged in landing. While making repairs he hit upon the idea that he could build a seaplane of his own. Before long Mr. Boeing was an aircraft manufacturer.

WILLIAM E. BOEING

• • •



ENGINEERING personalities in the public eye include Alfred V. deForest, widely known research engineer, who has been appointed associate professor of mechanical engineering at Massachusetts Institute of Technology. He has assumed his new duties.

This is the institution from which he was graduated in 1912. His investigations at M. I. T. are expected to lead to the establishment of a laboratory in which the knowledge and experience of the machine designer, the metallurgist and physicist can be focused on the working properties of machine materials.

In addition to investigations in magnetic analysis, Mr. DeForest long has been interested in the fatigue of metals and has developed several test methods. Since 1924 he has been secretary of the A. S. T. M. committee on magnetic analysis.

ALFRED V. DEFOREST

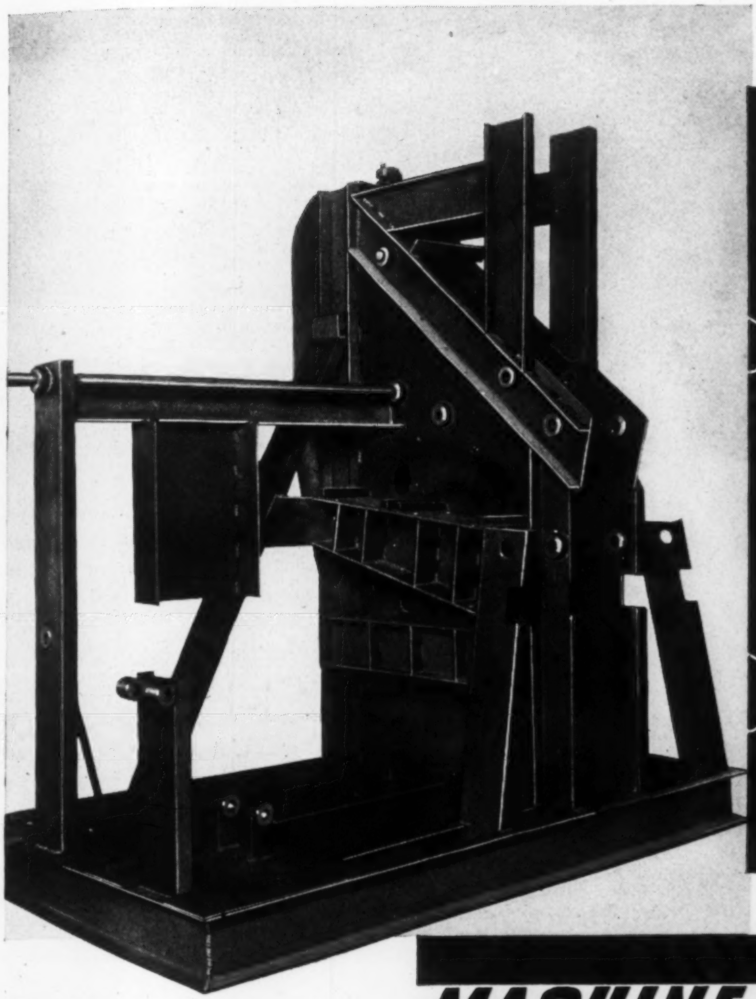
• • •

FOR his re-appointment as manager of engineering of the Westinghouse South Philadelphia works, Andrew D. Hunt is well qualified in practical engineering and in varied experience. Even before his graduation from Cornell in 1905 he had summer work in locomotive shops and in structural steel design.

In 1910 Mr. Hunt joined the staff of the Alberger Pump & Condenser Co. His next position (1919) took him into the marine sales force of the Westinghouse company where he assumed the direction of the marine section of the service department of this company's South Philadelphia works.

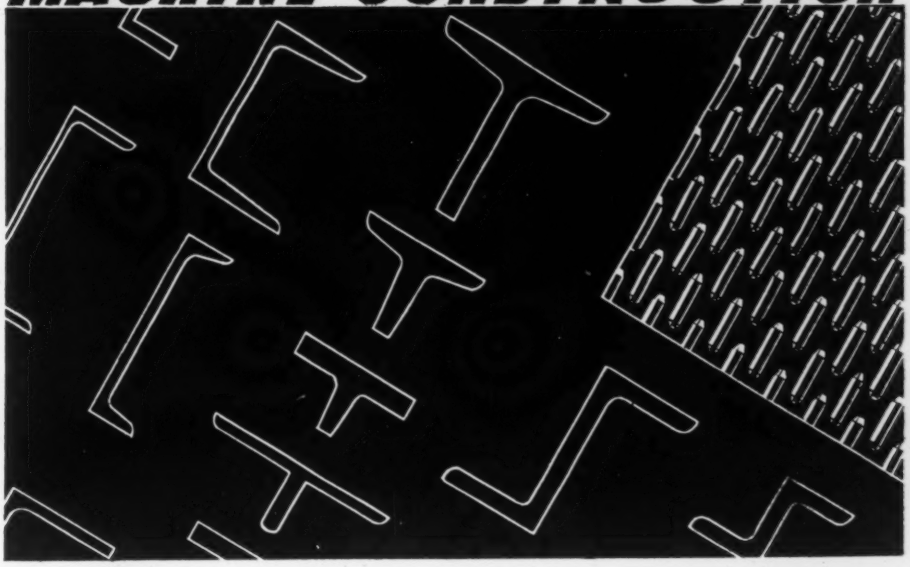
After holding the post of manager of steam service, he was in 1926 appointed manager of engineering. In June 1931, Mr. Hunt was transferred temporarily to the Chicago office of the

ANDREW D. HUNT



Arc welded frame
of coke pusher.
Photo courtesy of
Lincoln Electric Co.

STEEL SHAPES for MACHINE CONSTRUCTION



SUBSIDIARY OF UNITED STATES STEEL CORPORATION

US STEEL

CARNEGIE STEEL COMPANY

PITTSBURGH • PA.

286

company to act as steam specialist for the Northwestern district. He was recalled in October, 1932, to South Philadelphia to serve again in the capacity of steam service manager, and recently he resumed his duties as manager of engineering.

* * *

Dr. Albert Sauveur was awarded the newly created achievement medal named in his honor at the recent annual meeting of the American Society for Metals. The token henceforth will be known as the Albert Sauveur Achievement medal presented in recognition of advances in metallurgical knowledge.

* * *

Major Edwin H. Armstrong, prominently identified with radio engineering, has been appointed professor of electrical engineering at Columbia university, New York.

* * *

R. E. S. Geare, formerly chief engineer of the L. H. Gilmer Co., Philadelphia, recently was elected vice president in charge of sales and engineering.

* * *

Hebert W. Tinker, for several years chief engineer of Federal Pressed Steel Co., Milwaukee, has become general manager of Warner Electric Brake Mfg. Co., Beloit, Wis.

* * *

F. T. Irgins, chief engineer of the Outboard Motors Corp., Milwaukee, has been elected a member of the board of directors of that organization.

* * *

J. C. Redmond, formerly connected with the bureau of standards, Washington, has joined the technical staff at Battelle Memorial institute, Columbus.

* * *

D. A. Nemser has been appointed development engineer of International Nickel Co., with headquarters in Hartford, Conn.

* * *

Frank H. Driggs has joined the Fansteel Products Co., North Chicago, Ill. He formerly was connected with the research laboratory of Westinghouse Lamp Co., Bloomfield, N. J.

* * *

J. Edgar Pew, vice president, Sun Oil Co., Philadelphia, and chairman of the standards division of the American Petroleum institute, recently was elected to membership on the board of directors of the American Standards association.

* * *

George W. Kable has been appointed senior designing engineer, agricultural-industrial division, Tennessee Valley Authority, Knoxville, Tenn.

* * *

C. C. **Bradford**, Eaton Products Co., Cleveland, recently was elected president of the Leaf Spring Institute of America. Vice presidents are F. E. **Bedger**, Detroit Steel Products Co., Detroit, and F. J. **Trainor**, Trainor National Spring Co., New Castle, Ind.

* * *

John Hunter recently joined Riley Stoker Corp., Worcester, Mass., as an advisory engineer.

* * *

Hiram S. Lukens of the University of Pennsylvania has been elected president of the Electrochemical society.

* * *

Edward Hering has been appointed acting chief engineer of United States Pipe & Foundry Co., Burlington, N. J.

* * *

William Lloyd, for many years identified with the design and manufacture of Coxe stokers, has again become affiliated with the engineering department of the Combustion Engineering Co. Inc.

* * *

Porter H. Adams has been elected president of Norwich, Vt., university, one of the oldest engineering colleges in the United States. He has been acting-president of the institution since December, 1933.

* * *

Bancroft Gherardi, vice president and chief engineer of American Telephone & Telegraph Co., recently was appointed a representative of the American Institute of Electrical Engineers on the John Fritz metal board of award to succeed the late W. S. Lee.

* * *

Dr. Charles H. Herty Jr. has been appointed a research engineer in the development and research department of Bethlehem Steel Co. Dr. Herty was formerly Director of Research of the Mining and Metallurgical Advisory boards of the Carnegie Institute of Technology.

* * *

P. A. **McKittrick**, Parks-Cramer Co., is president of a new association which has been formed to foster and promote unit air conditioners. John A. **Dewhurst** has been appointed temporary secretary with offices at 330 West Forty-second street, New York.

* * *

John H. Geisse will head the newly formed development section within the bureau of air commerce, department of commerce. Principal object of the new section is to foster development of safer flying equipment, particularly for private use.

* * *

A. L. **Powell**, manager of the eastern office of the Nela Park engineering department of General Electric Co., recently was elected president of the Illuminating Engineering

(*Concluded on Page* 68)

POWER OUT OF CONTROL ALWAYS MEANS Waste

Unfortunately

NO SCREAMING SIRENS
CALL ATTENTION TO *INDUSTRY'S*
POWER-OUT-OF-CONTROL LOSSES

SCREAMING sirens tell the world when fire gets out of control. Unfortunately no sirens warn of another costly power-out-of-control waste which burdens many factories *every day*. . . . Electric motors are merely raw power. Improperly controlled, they waste where they should save, destroy where they are expected to produce.

No executive weighing the facts can possibly justify substitution for genuine Cutler-Hammer Motor Control. So widespread is the recognition for Cutler-Hammer superiority that many outstanding builders of motor-driven machines standardize on Cutler-Hammer Motor Control and actively feature it in their selling. The majority of electric motor manufacturers recommend it. Leading independent electrical wholesalers stock it for your convenience. Be sure your plant capitalizes the importance of Motor Control. Specify Cutler-Hammer for every motor or motorized machine. CUTLER-HAMMER, Inc., *Pioneer Manufacturers of Electric Control Apparatus,* 1310 St. Paul Avenue, Milwaukee, Wisconsin.

CUTLER HAMMER
THE CONTROL EQUIPMENT C-H GOOD ELECTRIC MOTORS DESERVE

This is the fourth of a new series of Cutler-Hammer advertisements in national magazines. Has appeared in Sept. 3 TIME; and appears in October FORTUNE. C-H Motor Control, most widely advertised, is a definite sales asset for any motorized machine. Standardize on Cutler-Hammer to speed your selling and assure the utmost in performance. C-H Machine Designers' Motor Control Manual supplied at no cost when requested on company letterhead.

NOTEWORTHY PATENTS

WHEN joining strands of certain materials as, for instance, mohair it has been difficult to prevent slippage of the strands and to maintain a firm joinder when the united strands are put under tension. Therefore it has been the object of Edward J. Abbott and Joseph E. Ring in designing their newly patented knot tyer to prevent such slippage. With the mechanism, *Fig.* 1, the knots are brought into such close relationship that tension on the united strand resists displacement of either of the cooperating and mutually reinforcing knots. Abbott Machine Co., Wilton, N. H., is assignee of the patent designated 1,965,023.

This discussion will omit many details of the machine, the primary purpose of course being to convey the idea; therefore, only the various elements involved in the actual tying of the knot will be treated. A cam follower is carried by an arm fastened to a rotatable post 50, *X, Fig.* 1, which carries upper arm 66. Link 65 is pivotally connected to this upper arm and to reciprocating plate 57.

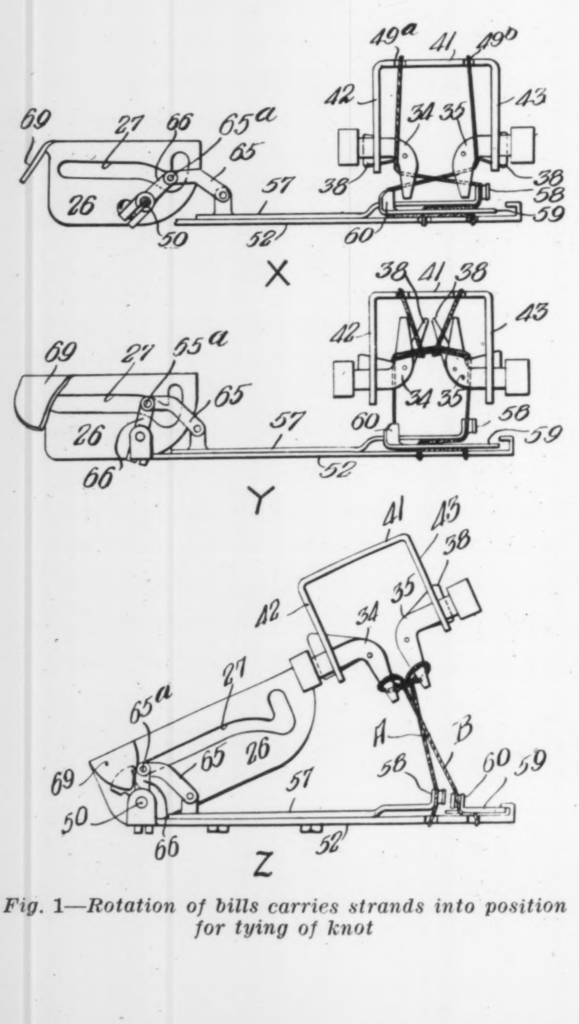


Fig. 1—Rotation of bills carries strands into position for tying of knot

The shape of the cam path 27 is such that during the first 180 degrees of rotation of bills 34 and 35, pockets 58 and 60 into which strands *A* and *B* are guided will move approximately to the position shown in *X, Fig.* 1. Thus is performed the joint function of carrying each strand into position to be engaged by one of the fixed blades of its adjacent bill and of carrying each strand into position to be engaged by the opposite bill outside of the partial loop or bight formed by the other strand thereon.

Further rotation of bills 34 and 35 permits the tail portion of the strands (placed in 49*a* and 49*b*) to slide over the rounded shoulders of the bills, until they are detained by and overlie the two strands connecting the bills.

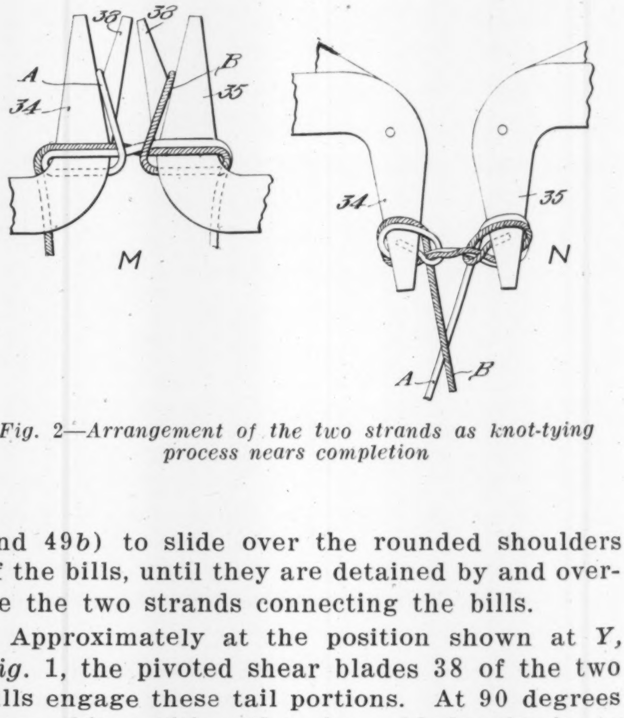


Fig. 2—Arrangement of the two strands as knot-tying process nears completion

Approximately at the position shown at *Y, Fig.* 1, the pivoted shear blades 38 of the two bills engage these tail portions. At 90 degrees from this position the shear blades begin to clamp and cut the tail portions, *M, Fig.* 2.

In this position it will be observed that around bill 34 there is a loop of strand *A* grasped by the blades of the bill and having a run of strand *B* within it; also around bill 35 there is loop of strand *B* grasped by the blades of the bill and having a run of strand *A* within it. This formation is effected for each bill to cast off its principal loop over the severed end thereof, thus

Let This New Hydraulic Lubrication System

SMOOTH THE WAY TO GREATER EQUIPMENT SALES

Add This New Selling Feature Without Making A Single Change In Machine Designs, and at Little or No Increase in Cost

IT'S AGREED THEN. WE'LL BUY THE MACHINES THAT ARE EQUIPPED WITH THE NEW **ALEMITE** HYDRAULIC LUBRICATION SYSTEM.
ABSOLUTELY! AND THAT IDEA FOR MODERNIZING OUR PRESENT EQUIPMENT IS A GOOD ONE, TOO. WE'LL SAVE ALL ALONG THE LINE WITH **ALEMITE.**

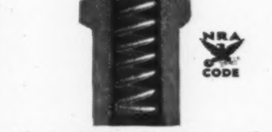
The Fact That Machines Lubricated This New Way Take Less Time, Labor and Lubricant to Maintain Will Make Your Product a "Standout" Against Competition

THE remarkable new Alemite Hydraulic Lubrication System, providing positive, adequate lubrication to all bearing surfaces at low cost, makes any machine easier to sell.

Executives charged with holding down production costs are on "your side" the moment you explain how the Alemite Hydraulic Lubrication System eliminates costly delays and repairs and insures more efficient operation. The mention of the name Alemite brings instant recognition, arouses interest—helps to "clinch" the deal.

Write today for complete engineering information on this outstanding lubrication advancement. Remember: Machinery already made up or now in operation, whether lubricated by oil holes, grease cups or earlier Alemite systems, can be modernized quickly and easily by changing over to the new Alemite Hydraulic Fittings. Send your letter to:

ALEMITE CORPORATION
(Division of Stewart-Warner Corporation)
1890 Diversey Parkway Chicago, Ill.



Alemite Hydraulic Fitting with cross-sectional view of coupling.

HERE'S HOW IT WORKS

The Basic Principle of New Alemite Hydraulic Lubrication System

This new system embodies a new principle of applying lubricant through new fittings. It cuts time, labor and lubricant required to service bearings and assures positive lubrication under any and all conditions.

A coupling of entirely new design is used in combination with a new-style fitting or nipple to effect the most perfect seal which has ever been possible. This coupling actually grips the fitting so quickly that contact between gun and any fitting is established instantly.

The coupling STAYS LOCKED on the fitting—cannot slip off—so long as pressure is being applied. As pressure increases, the grip of the coupling increases—"the greater the pressure, the tighter the seal." With this system, it is easily possible to build pressure up to 10,000 pounds per square inch by hand!

Like former Alemite systems, the new Alemite Hydraulic comprises fittings of all necessary angles and sizes, and adapters for both power and hand operated guns.

ALEMITE NEW HYDRAULIC LUBRICATION SYSTEM

REG. U. S. PAT. OFF.

forming a knot, *N, Fig.* 2, and for the inclusion within the formed knot of the opposite strand which is detained by the loop and grasped end.

AN AUTOMATIC control mechanism for can making machines has been patented by H. A. Fink and John E. Schmidt. This mechanism is associated with each machine so that when any portion of the line becomes filled with cans so that there is no further room for the output of any particular machine in the line, that machine will be stopped automatically.

As the cans move along, contact member 45, *A, Fig.* 3, will move along with them, being rotated by shaft 26 through gearing 30. When the cans stop due to the fact that there is no place to store them or no machine to take the cans from the runway, they will accumulate, the can conveyor and its cable 24 slipping beneath them. The stationary cans cause contact member 45 to stop and likewise shaft 26. When this shaft is restrained against rotation, the friction clutch faces between sleeve 28 and sleeve 35 will merely slip one on the other.

On the upper end of shaft 26 is a support 48, this support being attached rigidly to the shaft to rotate with it. A mercury switch 50 is pivoted on bracket 49. Two wires 56 and 57 extend into the switch chamber and are connected electrically by the mercury. When member 48 is rotated centrifugal force will cause the switch to tilt, carrying the mercury to the other end of the tube and breaking the electric circuit. When however, the member 48 stops, the tube will swing in the opposite position because the pivotal support of the tube is nearer the outer than the inner end. When in this position mercury running to the left-hand end of the switch chamber will establish the circuit.

Wires 7 and 58 through commutators 60 and 61 are connected to solenoid 30, *B, Fig.* 3. When the cans clog for any reason, support 48 will be stopped and an electric circuit will be established, thereby energizing the solenoid. Subsequently bellcrank 12 is turned in a clockwise direction shifting valve 6 to the right and establishing connection through port 9 between valve chamber 7 and the cylinder which will move piston 4 to the right. This will effect movement of the clutch lever to stop the machine.

The patent for this mechanism has been assigned to Continental Can Co., New York. The number is 1,963,082.

Review of Noteworthy Patents

Other patents pertaining to design are described briefly as follows:

FORMING ARTICLES OF RUBBER—1,974,209—Covered by this patent is apparatus for and method of forming articles of rubber. Assigned to Hood Rubber Co. Inc., Watertown, Mass.

GASOLINE ENGINE STARTER—1,973,218—One object of this design is to provide a starting clutch and foot lever adapted to start and accelerate an engine by treading on the floor lever. Assigned to The Maytag Co., Newton, Ia.

WEB CUTTING MECHANISM—1,969,480—This invention relates in general to sheet control mechanism for printing machines. Its principal object is to prevent premature displacement of the sheet and to provide an improved knife for use in connection with cutting and folding cylinders. Assigned to R. Hoe & Co., Inc., New York.

CAM ELEMENT—1,968,945—The invention concerns a machine element for transmitting power with a camming action, one object being to provide a cam section which is adjustable, and which will provide under all positions of adjustment, an uninterrupted surface for contact with the member upon which the camming action is imposed. Assigned to Wildman Mfg. Co., Norristown, Pa.

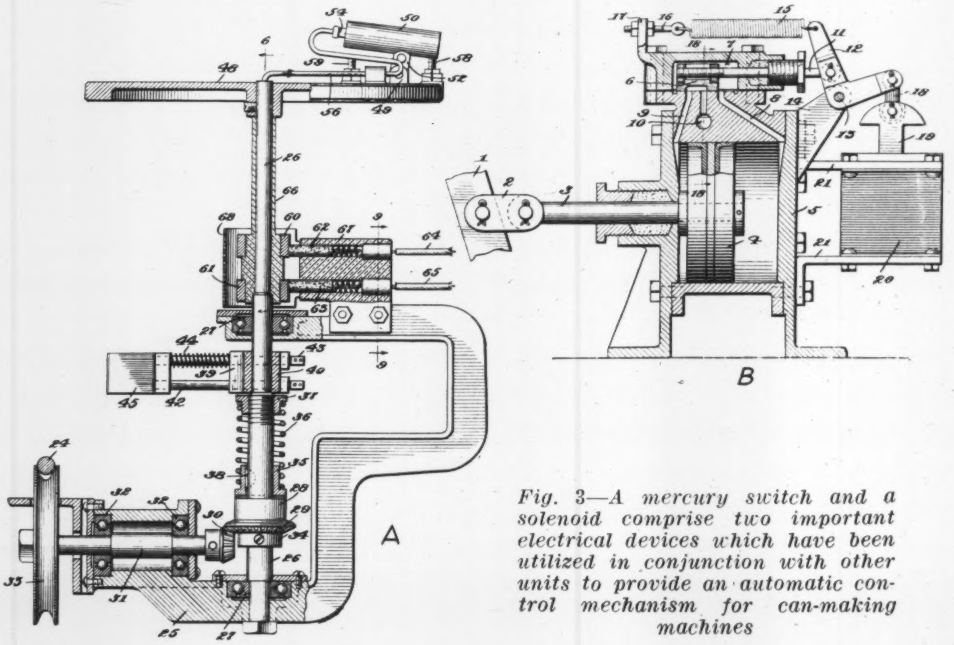
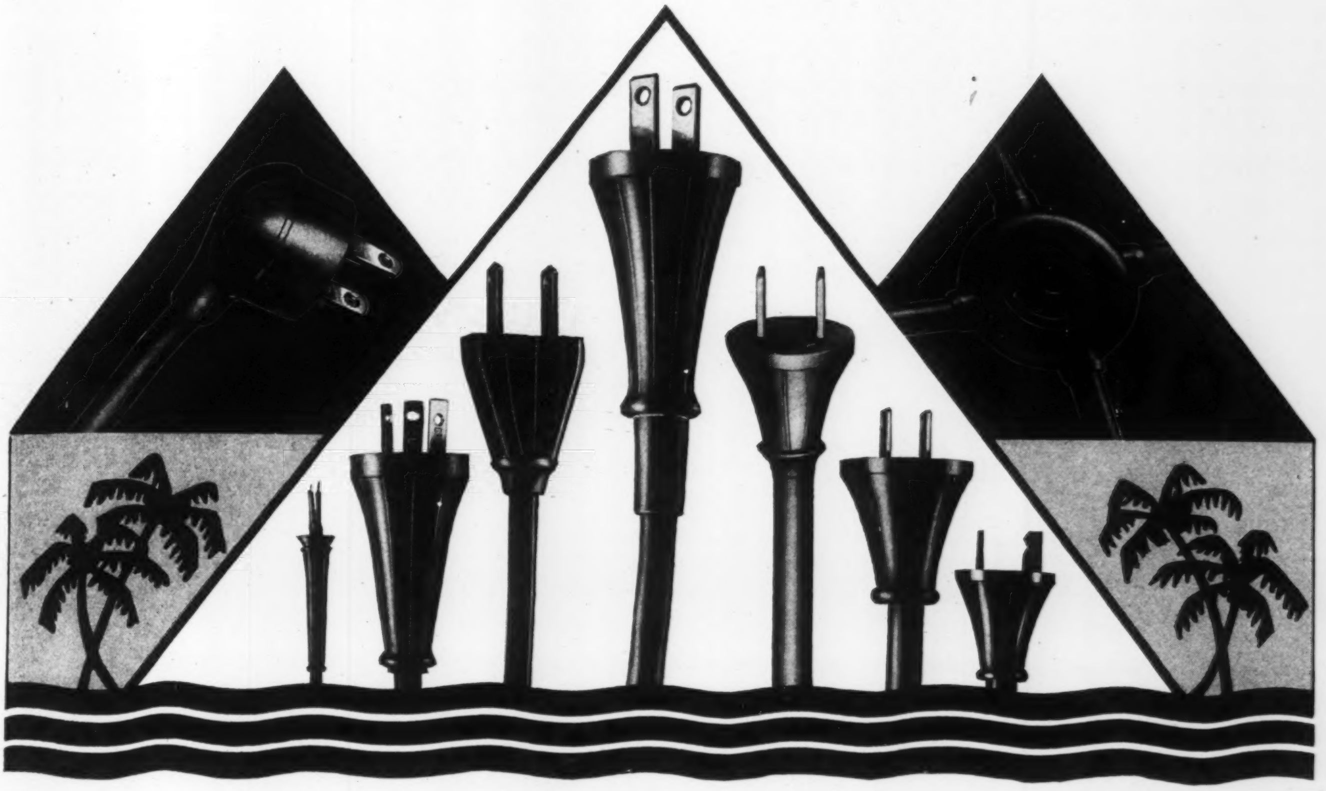


Fig. 3—A mercury switch and a solenoid comprise two important electrical devices which have been utilized in conjunction with other units to provide an automatic control mechanism for can-making machines



G-E ALL-RUBBER PLUGS

AS SIMPLE . . . AS PERMANENT . . . AS THE PYRAMIDS

Like the Pyramids, G-E All-rubber Cord Sets with *moulded-on* plugs withstand the ravages of time. They are the simplest, surest cord sets made — they assure dependable, continued performance.

G-E All-rubber Cord Sets with the plug moulded fast to the cord (not merely attached) keep appliances in constant operation — give years of service — never need replacing. The weak point of the old-type cord sets is entirely eliminated. There is no point of attachment of the cord to the plug on the G-E Cord Sets — the plug and cord are all one. Contacts are soldered to the cord and moulded in rubber — there is nothing to come apart. They defy abuse — are practically indestructible.

The appearance of your product is improved by using the line of G-E All-rubber Devices — moulded fast to the cord. All types of rubber plugs, strain reliefs, connectors, angle caps and delta connections are available — moulded fast to any type cord. They not only meet but surpass all Underwriters' tests and requirements. Only General Electric can supply this well constructed, original line that guarantees satisfaction.

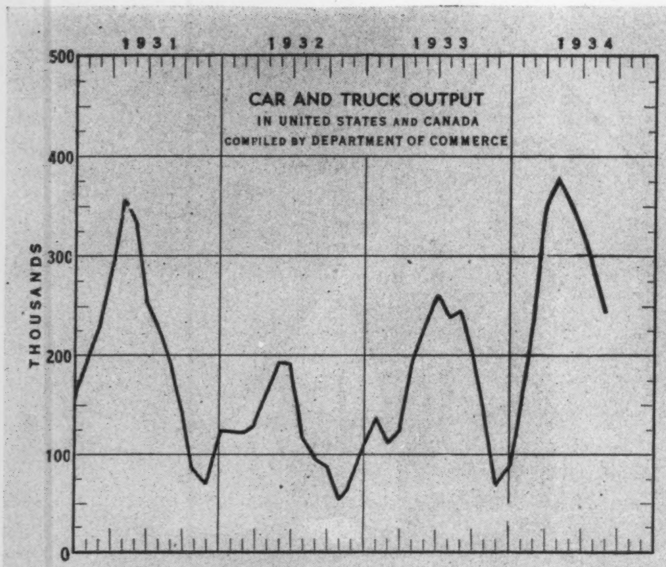
For complete information on G-E All-rubber Devices write Section Q-4510, Merchandise Department, General Electric Company, Bridgeport, Connecticut

GENERAL ELECTRIC

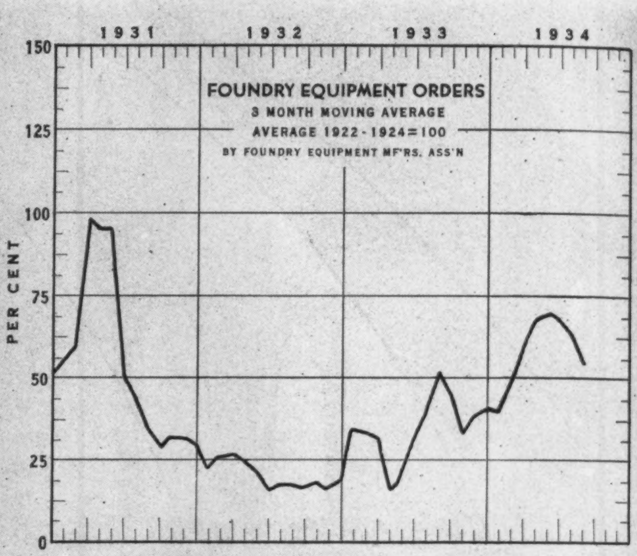
ACCESSORY EQUIPMENT

MERCHANDISE DEPARTMENT, GENERAL ELECTRIC COMPANY, BRIDGEPORT, CONNECTICUT

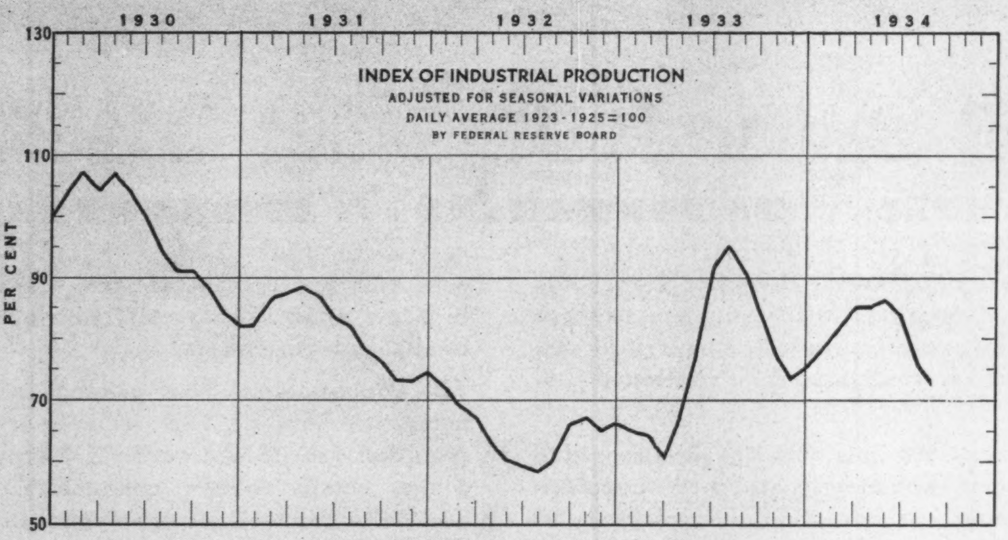
How Is Business?



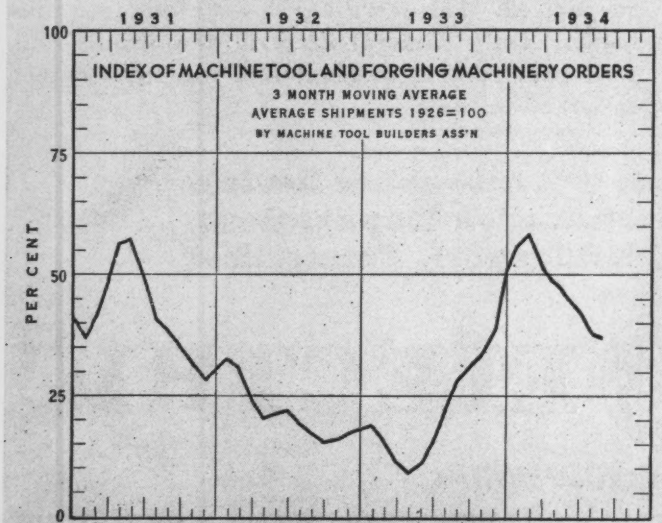
August 1933, 238,934—*August* 1934, 244,713



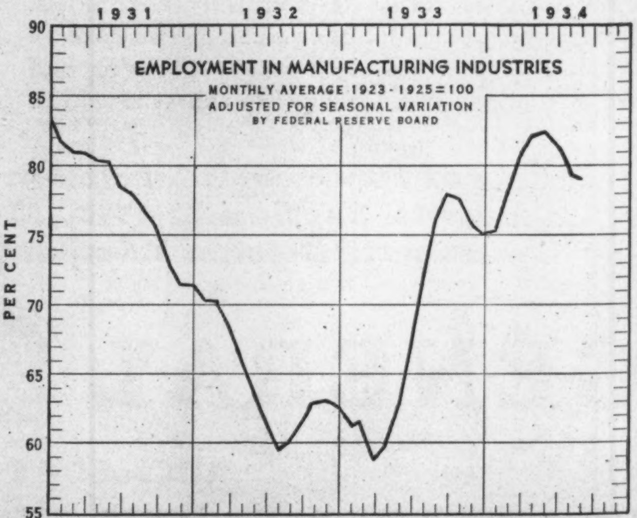
August 1933, 50.2—*August* 1934, 54.7



August 1933, 91—*August* 1934, 73



August 1933, 27.9—*August* 1934, 37.1



August 1933, 76.4—*August* 1934, 79.2

WHERE GEARS TAKE PUNISHMENT··*SPECIFY*

ILLINOIS
S·A·E·4615

FOR gears requiring an especially hard, durable steel—tractor ring gears, and other automotive ring gears—Illinois produced S. A. E. 4615, a nickel-molybdenum case hardening steel which can be treated at relatively low cost.

A controlled electric furnace practice assures uniformly fine grain with a high degree of cleanliness. Illinois' S. A. E. 4615 machines readily and responds to case carburizing with minimum warpage or distortion.

For many applications a single quench is adequate to provide physical properties ordinarily obtainable in other steels only with double quench.

For suggestions on the application of Illinois S. A. E. 4615 for gears, bearing races, piston pins, king pin bolts and other parts, write for an appointment with our representative.

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SUBSIDIARY OF UNITED STATES STEEL CORPORATION

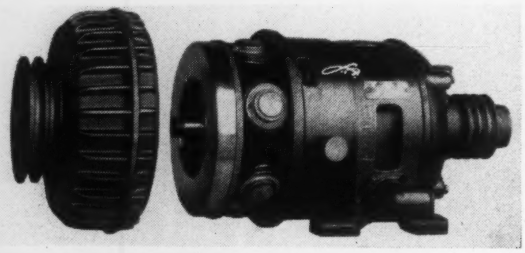
ILLINOIS *alloy* STEELS

ALWAYS DEPENDABLE

NEW MATERIALS AND PARTS

Announces Unique Drive Unit

DYNAMATIC drive units for trucks and buses are a new development of Louis Allis Co., Milwaukee. This unit, shown herewith, is a combined speed controlling power transmission and alternating current motor for use in the conversion of the variable speeds produced by the gasoline engine of an automobile to the correct speed for operating auxiliary machinery (such as a refrigerating compressor) on a moving automobile or truck, and to continue such power supply while the vehicle is in a garage or loading warehouse by connection to a regular alternating current power line.



No mechanical connection exists between driven member and driving shaft in this drive unit

There is no mechanical connection between the driven member and the driving shaft of the unit. It is fully electrical and is said to range up to over 80 per cent efficient at normal operating speeds. The drive takes its power from a power take-off shaft connected to the truck engine. Ball bearings and shafts are oversize. It is extremely compact, being only 12 inches in diameter and about 22½ inches overall including pulleys.

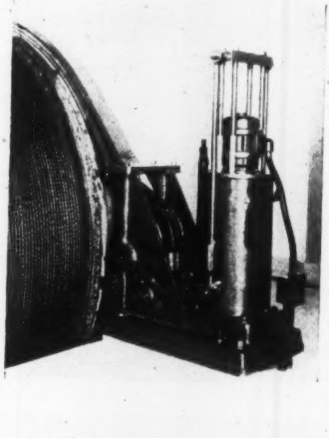
Micrometer Heads Are Redesigned

PARTICULARLY suited for use with rugged machines and fixtures which will be subjected to unusually severe requirements, a new one-inch micrometer head, No. 296, has been developed by Brown & Sharpe Mfg. Co., Providence, R. I. The micrometer head may be used as an integral part of a fixture, or by means of a clamp for making fine measurements and adjustments. Length of shank is 13/16-inch; diameter of shank is ½-inch.

Thrustors Are Improved

IMPROVED thrustors, a self-contained combination of motor-driven centrifugal pump, oil chamber and piston that produces a smooth straight line thrust through a definite length of stroke, have been announced by General Electric Co., Schenectady, N. Y. The new line of thrustors, especially suitable for the operation of clutches, brakes, valves, doors, etc., consists of a complete range of standard models providing 10 combinations of thrust and stroke ratings varying from 50 to 3200 pounds thrust and from 2 to 16 inches stroke.

In the new unit, shown herewith, the impeller housing of the centrifugal pump is stationary, a rigid shaft running in ball bearings connecting the impeller to the driving motor. A number of driving motor arrangements are available, in either alternating or direct current. All motors are totally enclosed (except direct current and single phase motors on the 50-pound size) for protection against dirt and moisture. For single phase service capacitor motors are used on



A number of driving motor arrangements for operating thrustor are available in either alternating or direct current

The Wagner Net-Work

of 25 factory branches is your assurance - - -

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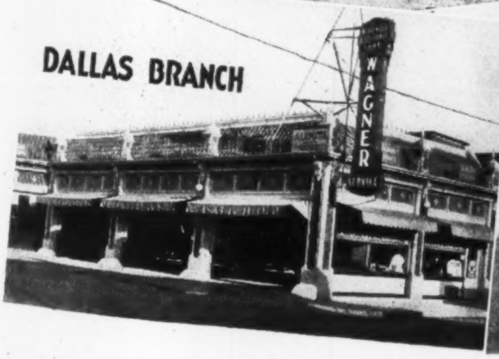
DALLAS BRANCH

that wherever your customers may be located, there is a Wagner service branch and a staff of motor experts nearby — whether in Maine or Oregon, in Minnesota or Texas.

When selecting a make of motor, it is very important to give consideration to the service the motor manufacturer can give your customers. It makes your sales story much stronger and more convincing when you can point to definite plans you have for nation-wide handling of motor service or application problems — *for when your customers need replacal motors or repair parts, they usually want them without delay.*

Twenty-five branches, like those illustrated here, carry a complete stock of standard motor parts, available for immediate shipment.

When you select Wagner, you add the entire Wagner organization to your own.

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Motors Transformers Fans Brakes

M134-1

25 FACTORY BRANCHES

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CHICAGO
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MINNEAPOLIS
NEW YORK
OMAHA
PHILADELPHIA
PITTSBURGH
PORTLAND
SAN FRANCISCO
SEATTLE
ST. LOUIS
TORONTO

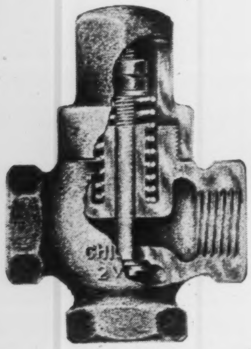
A Wagner motor-repair department. Detroit Branch illustrated.

all thrustors rated 100 pounds and greater thrust. For 25-cycle service, a special step-up gear train is provided to obtain the same impeller speed as that produced in 60-cycle service. For 50-cycle supply, impellers of slightly greater diameter are used to maintain rated thrust capacity.

Interchangeable base plates are available for clevis or rigid mounting of the device. Tilting as much as 45 degrees away from the vertical is permissible with the new thrustor. It is also designed for continuous operation with the piston in the stalled position.

New Relief Valves Are Available

NEW RELIEF valves for industrial use are being introduced by Tuthill Pump Co., Chicago, in six sizes with two pressure ranges. Model V is built in sizes from 3/8 NPT to 1½ NPT for relieving pressures from 5 to 35 pounds. Model VH covers the same sizes for relieving pressures from 35 to 100 pounds. The only difference between the models is the springs; and springs are interchangeable.

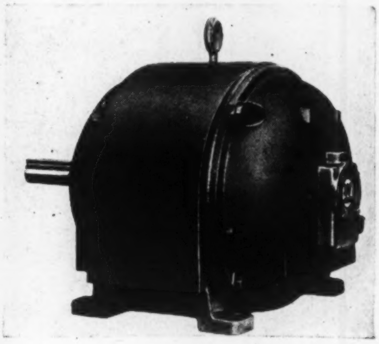


Spring compartment of valve is ventilated to the valve body proper to insure positive action

The spring compartment of the valve is vented to the valve body proper to insure positive action. Assembly is simplified by constructing the relief pipe at right angles to inlet and outlet, while mounting is simplified by building the valve in the form and shape of a pipe T. The valve may be mounted in any position.

Motors Designed To Be Splash Proof

SPLASH proof, drip proof and weather proof motors for use indoors or outdoors or for any applications where dripping or splashing liquids are encountered are being offered in a new line by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. These motors, shown herewith, are entirely new in that they are not adaptations of an open machine with enclosures applied around the frame, but they have been built with the motor frame and end brackets of solid castings for this special class of service. The cast iron being of thick cross section and inherently resistant to rust and corrosion, makes this motor highly resistant to the sour gases encountered around a refinery or the chemicals which may be encountered in a chemical plant, paper mills, etc. Even the conduit box is made of cast iron so that there are no exposed sheet steel parts to be attacked by corrosion.

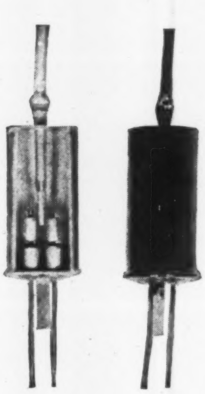


Drip-proof motor is highly resistant to the sour gases encountered around a refinery or chemicals in a chemical plant

A baffle plate cast integral with the inner side of the motor bracket prevents splashing liquids from reaching the motor windings. These motors are offered with either ball or sealed sleeve bearings. They are rated 50 per cent continuous and are offered in both the squirrel cage and wound rotor types.

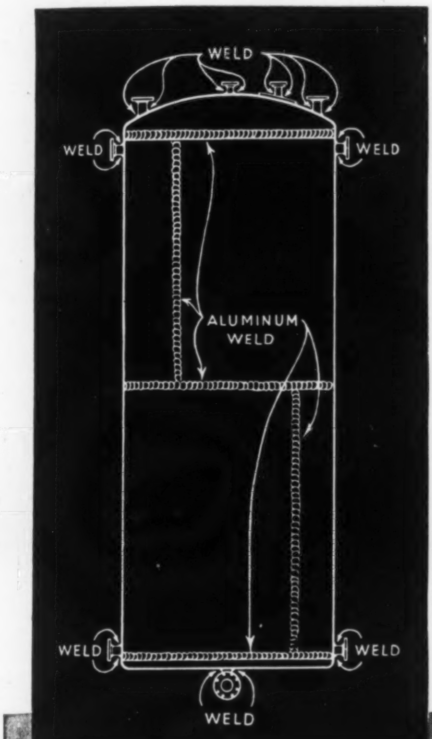
Switch Operates in a Vacuum

DESIGNED to take advantage of the absence of an arc when breaking a circuit in a high vacuum, the new small vacuum switch developed by General Electric Co., Schenectady, N. Y., is built almost entirely of steel. Although this switch, shown herewith, is only about ¾-inch diameter and 1½ inches long, and can be operated by a fraction of an ounce of pressure, it is capable of interrupting as much as five



Flexibility of thin steel end-wall permits the slight motion necessary for operation of the contact on vacuum switch

Design for OXWELDING *and specify the Best*



A LONG successful record of chemical equipment designed for oxwelding and built with the advice and assistance of Linde Process Service is reflected in the following quotation from a chemical firm's specifications for six large aluminum tanks:

"Welding is to be by the oxy-acetylene process using Oxweld Aluminum Welding Rod and Oxweld Aluminum Flux. Special care is to be taken as the tank is to contain acid. The approval of each welder must be obtained through a qualification test from The Linde Air Products Company before welding is done."

Before planning equipment this firm has regularly obtained from Linde the latest data on performing the specific welding job and specifications have been drawn to require techniques, materials, and testing methods proved in the vast experience of Linde Process Service. In this way the soundest, strongest, most economical fabrication is assured.

You can have this in your equipment too, by simply taking advantage of Linde Process Service. The nearest Linde Sales Office will be glad to explain this service to you. Phone or write now.

• • •

Continuing previous records for service, Linde advised on the correct type of oxwelded joints and the welding materials for building these 3000-gal. aluminum tanks. Every seam was leakproof under hydrostatic test. All welders were rigidly qualified by Linde.

THE LINDE AIR PRODUCTS COMPANY

Unit of Union Carbide and Carbon Corporation

UCC

IN CANADA, DOMINION OXYGEN CO., LTD. TORONTO

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES • UNION CARBIDE

PRODUCT OF A UNIT OF UCC UNION CARBIDE AND CARBON CORPORATION

You are cordially invited to visit the numerous exhibits sponsored by the Corporation in both the Basic and Applied Sciences in the Hall of Science at Chicago's 1934 A Century of Progress Exposition. Here you will see how users of products and processes developed by Units of Union Carbide and Carbon Corporation benefit from a most unique coordination of scientific research with manufacturing, sales and service facilities.

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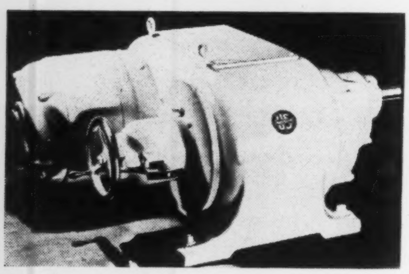
NRA CODE

horsepower thirty times a second. Designated as the type FA-6 vacuum switch, this new device is rated at 10 amperes, 250 volts direct current or 440 volts alternating current, or at 5 amperes at 500 volts direct current.

As noted, the switch is made of steel which is hydrogen-copper brazed. It is exhausted to a high vacuum through a hollow steel operating stem. This operating stem passes into the vacuum contact chamber through a thin steel end-wall, the flexibility of which permits the slight motion necessary for operation of the contact. With this construction, the switch can be used in almost any location, including those subject to severe shock and vibration.

Offers Geared Variable Speed Units

COMBINING a variable drive with a synchro-gear arrangement, U. S. Electrical Mfg. Co., 1510 South Western avenue, Chicago, and 202 East Slauson avenue, Los Angeles, has developed a drive with which infinitely variable speeds can be obtained yet one that permits the operator to obtain much lower speeds than in former units. The variable speed drive consists of a simple squirrel cage motor built integral with a variable speed transmission which comprises dual disks coupled with a varibelt. Speed changes are obtained by varying the effective diameter of the disks. The operator merely turns a handwheel which actuates a traveling hub. This, in turn, increases or diminishes the distance between the two sides of the driven disks.


Gears, motor and variable speed mechanism are combined in a single unit to give a compact drive

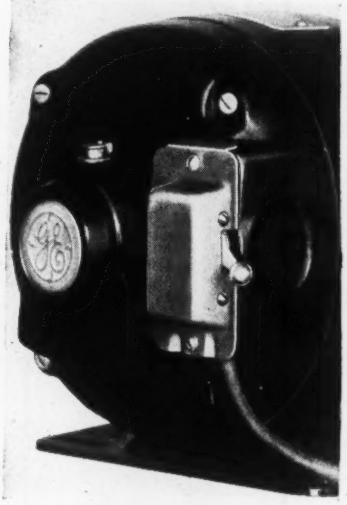
The gear compartment of the new unit is fully enclosed, thus excluding foreign matter. The motor compartment is comprised of a standard rotor with autostart principle. This rotor is asbestos protected.

Introduces Improved Electrodes

HEAVILY-COATED arc welding electrodes, designated as Type W-23, designed for the economical production of high speed, high quality welds in the flat position, have been brought out by General Electric Co., Schenectady, N. Y. The electrodes are suitable for either manual or automatic arc welding and will produce equally good results on either alternating or direct current. With the latter, reverse polarity is used.

Motor Starting Switch Is Compact

A COMPACT starting switch, designed for use when hand-operated control at the motor is required and intended for direct mounting on the built-in terminal box of standard fractional horsepower motors, has been announced by General Electric Co., Schenectady, N. Y. The device, shown herewith, is mounted in a substantial steel case and is provided with a positive snap-action mechanism. It replaces the standard terminal box cover plate and requires no soldered connections or additional wiring.


Compact switch for hand operation of motors replaces standard terminal box cover plate and requires no soldered connections or additional wiring

The switch is of the single-pole type, rated 6 amperes at 125 volts or 3 amperes at 250 volts. It is suitable for use where overload protection is not required and where the locked rotor current of the motor need not be broken. Typical applications include: Woodworking tools, home workshop equipment, valve grinders, cylinder reborers, drills and paint sprayers.

Distinctive Wire Coverings Announced

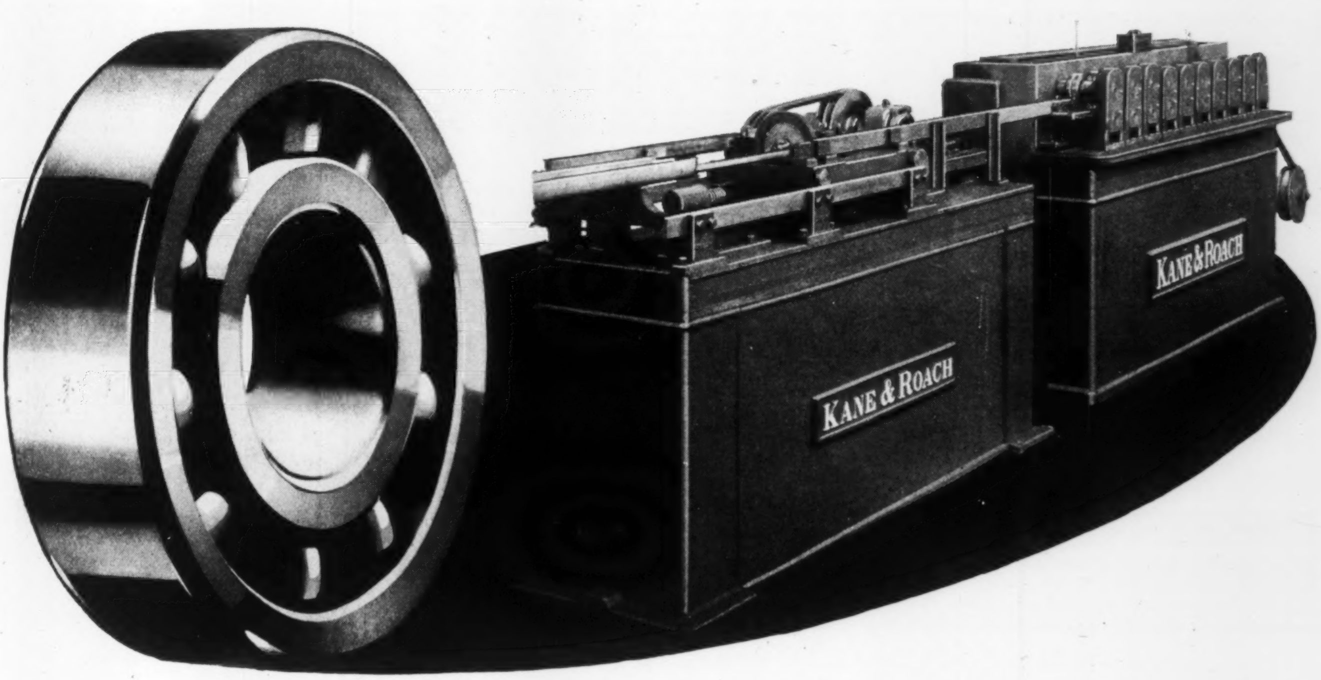
TWO DIFFERENT insulations for electrical wire have been developed and applied by engineers of DuPont Cellophane Co. and Belden Mfg. Co., Chicago. The first is the development of a method of applying cellophane to magnet wire, and the second the use of a new synthetic rubber, "Duprene" as protective covering on ignition cable.

Celenamel, as the new magnet wire is called,

Fabrication of Tubing..

AT 300 FT. PER MINUTE

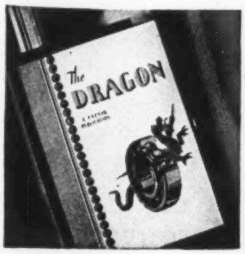
promoted by 81 FAFNIRS



Copper or brass lock seam radiator tubing is the product of this new Kane & Roach Cold-Roll Forming Machine and Flying Saw. 5 H. P. do the trick with the aid of the Fafnir Ball Bearings and enable strips to be formed into tubing, tinned and cut at the extremely high rate of 200 to 300 feet per minute.

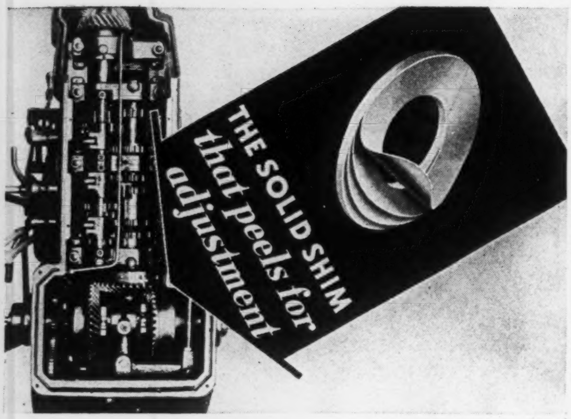
Saving power and increasing speed in the forming machine involved the use of 18 matched pairs of Fafnir Single Row and Fafnir Grease-Shield Bearings in the front of the main frame and 22 of the same size in the rear; the outboard housings are likewise so equipped. The flying saw incorporates Fafnir Flange Cartridges, special Precision Types and Double Row Grease-Shield Ball Bearings.

All this helps but to demonstrate again that Fafnir has the ideal bearing for every application. Kane & Roach Inc., are also in accord with the hundreds of users whose experience has proven conclusively that Fafnirs can be depended upon to carry the loads with practically no attention other than periodic lubrication . . . THE FAFNIR BEARING COMPANY, *New Britain, Conn.* Atlanta . . . Chicago . . . Cleveland . . . Dallas . . . Detroit . . . Milwaukee . . . Minneapolis . . . New York . . . Philadelphia.



Interesting installations which are producing profits for the users are described in Fafnir's House Organ, "The Dragon". We will gladly include your name on the mailing list. Just drop us a line.

FAFNIR-BALL BEARINGS



Production Drill, Barnes Drill Company.

• quick gear and bearing adjustment a feature of Barnes drills

By installing Laminum shims for quick service adjustment of gears and roller bearings, Barnes makes it easy for users to keep Barnes drills always in correct adjustment. Better work . . . longer equipment life . . . lower upkeep cost!

Quick adjustments of .002 or more at a time by simply *peeling* the laminated brass shim. No miking . . . no filing. As "solid" as solid shims . . . no "cushion"; no "squeeze". Always as smooth as glass and as hard as solid brass . . . no matter how many layers have been peeled off.

LAMINUM

LAMINATED SHIM COMPANY, INC.
2126 Forty-fourth Ave., Long Island City, N. Y.

529

This Discharge Clears Motor-
Installation is Simplified

Such an advantage, plus its operating efficiency, makes this just the pump for many a centrifugal installation. Circular sent on request. Brown & Sharpe Mfg. Co., Providence, R. I.

Brown & Sharpe
Centrifugal Motorpump
No. 210

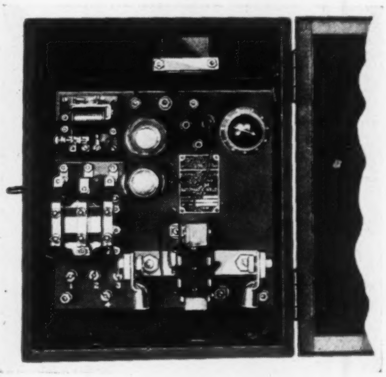
B·S

has greatly increased dielectric strength, and requires less space than previous wires. The cellophane is bonded to the wire with an adhesive. It cannot unwrap when cut or open when bent at sharp angles. The cellophane covering, which is sealed with a baked lacquer finish, protects the enamel insulation against heat and varnish solvents.

The rubber covered wire is intended for use in such places where heat, oil and corona conditions are most deadly.

Announces New Weld Timer

FOR USE with resistance welding machines, Electric Controller & Mfg. Co., 2702 East Seventy-ninth street, Cleveland, has announced the Folio 2 automatic weld timer. Although it operates on the same principle as the Folio 1 timer, namely that of taking into consideration the many variables entering into the welding circuit and timing the weld with respect to the current flow, this new design is a considerable improvement over its predecessor. It contains less apparatus, the dust-tight enclosing cabinet is smaller and not as deep, and the operation of the timer is twice as fast as the previous one.



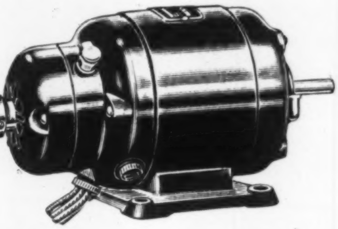
Operation of new weld timer is twice as fast as that of previous models

Larger Motors Announced

A NEW addition to its line of electric governor-controlled motors was recently made by Bodine Electric Company, 2264 West Ohio street, Chicago, in ratings ranging from 1/10 to ¼ horsepower. Heretofore, all Bodine governor-controlled motors were smaller than 1/10 horsepower. The new line is available in series and compensated series types of motors with an approximate speed range from 500 to 7500 revolution per minute.

These motors, shown herewith, are also available with built-in worm gear speed reducers of various ratios, the highest of which is sixty to one.

The accuracy of speed control closely approaches the performance of synchronous motors. The present speed is not readily affected by variations in load if the loads are kept within the capacity of the motor. The electric governors are of two forms—Form R can be adjusted while the motor is running; Form S can be adjusted only at standstill.



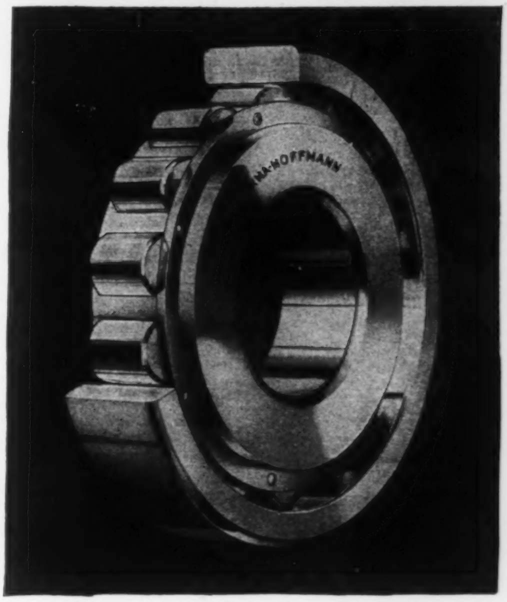
Larger sizes of governor-controlled motors are available with built-in worm reducers

Drafting Machine Has Full Range

EMBODYING mechanical features which are said to save 25 to 40 per cent drafting time, a new drafting machine is being introduced by Charles Bruning Co., New York and Chicago. This machine, shown herewith, is known as the Bruning-Wallace drafting machine. It completely eliminates the use of T-square, triangles, scales and protractor. The machine is easily clamped on the edge of the drafting board and is rigidly anchored by means of T-clamps.

Drafing machine eliminates necessity for T-square, triangles scale and protractor

An important advantage of the machine is that it makes every part of the drafting board accessible, the protractor head revolving in a full circle. The machine is equipped with five precision ball bearing assemblies, each of which is totally enclosed. These bearings are lubricated and sealed at the factory, no clean-



for SEVERE RADIAL and SHOCK LOADS

PRECISION ROLLER BEARINGS afford—for extreme load conditions—the following outstanding advantages . . . Solid, cylindrical rollers, held to infinitesimal limits of accuracy, provide larger steady load and shock capacity than any other single-row bearing, together with a temporary overload capacity of 50% . . . Short roller construction affords ideal load distribution and greater wear resistance . . . Extruded bronze, machined and balanced, heavy-duty retainer is land-riding, relieving the rolling elements of its weight . . . Extreme refinement of design and finish gives a lower coefficient of friction under severe load than any other type of bearing and permits speeds up to 35,000 R.P.M. . . . PRECISION ROLLER BEARINGS interchange in size with all standard ball bearings . . . Write for the catalog. Let our engineers work with you. . . . .

"NORMA-HOFFMANN"
PRECISION BEARINGS
BALL. ROLLER AND THRUST

NORMA-HOFFMANN BEARINGS CORP. STAMFORD, CONN., U. S. A.

VIKING

The pump of WIDE ADAPTABILITY

VIKING Rotary Pumps are offered in three general classifications . . Standard, Hydraulic and Coolant.

The Viking Standard Pumps offer low power requirements, high efficiency and long life in the handling of practically all grit-free liquids of widely varying viscosities. Capacities range from 1/5 to 1,050 G.P.M. Available in all drives and mountings.

Viking Hydraulic Oil Pressure Pumps are especially adapted to the operation of hydraulic elevators and lifts and to the actuation of machine tool movements. In capacities of 5, 10, 13, 20, 35 and 45 G.P.M.

Viking Coolant Pumps, in capacities of 5, 10, 15, 20 and 35 G.P.M. with built-in relief feature offer a smooth, even flow so essential to efficient coolant operation.

All Viking Pumps incorporate the world famous "Two Moving Parts" Principle. All are made of laboratory-tested metals to the close precision of a fine watch. Write for complete FREE Details on the low-cost, long-life VIKING.

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Small Motors

In sizes from 1/1000 to ¼ H. P.—plain or back-geared—Universal or Shaded Coil Induction or Split Phase types—and a background of over 40 years of successful motor manufacturing as your assurance of dependable, high quality motors at reasonable prices.

Write us about your requirements.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan

OFFICES IN PRINCIPAL CITIES

SIGNAL
MANUFACTURERS OF ELECTRICAL PRODUCTS

ing or lubricating being required during the life of the machine. All cast parts are of heat-treated aluminum alloys.

Welders Employ Alternating Current

IN ADDITION to its line of direct current arc welding equipment, General Electric Co., Schenectady, N. Y., now has available a complete line of alternating current arc welding equipment including transformer units, electrodes and automatic welding heads and control. The new alternating current equipment is intended for heavy current welding, primarily automatic welding because of the heavy current involved, but it is otherwise equally well suited to hand applications.

They Say—

"We sent representatives to the shows last year, and we plan to do so again this year. We want to know about new machines and new features of present machines, and our policy is that we shall spend whatever money is necessary to secure and disseminate this knowledge."—G. L. Harris, Westinghouse Electric & Mfg. Co.

□ □ □

"Scientific development and contemporary design are going to work in closer co-operation in the future. The changing consumer desires and the competitive marketing conditions are demanding it. Lessons learned from the success of industrial design for the consumer can be profitably applied in the designing of factory equipment in the future."—Ben Nash in *Manufacturing and Industrial Engineering.*

□ □ □

"The need for replacement of old equipment by modern machines is obvious to hundreds of potential buyers. But in the face of present monetary uncertainty, and possibility of further governmental restrictive measures, these potential buyers are afraid to commit themselves to any purchases save those which are absolutely necessary to keep the wheels turning from day to day."—Philip E. Bliss, Warner & Swasey Co.

□ □ □

"The foresight of the manufacturers of furnaces, oil burners, radiators and other products has clearly indicated the profitable possibilities of making unsightly mechanisms take on an importance and a value while helping to secure a greater care in their operation from the user. It would seem that a lesson can be learned from this experience for fuller use in machine equipment in manufacturing plants."—Ben Nash in *Manufacturing and Industrial Engineering.*

Gun Lathe Incorporates Unique Feed

(Concluded from Page 28)

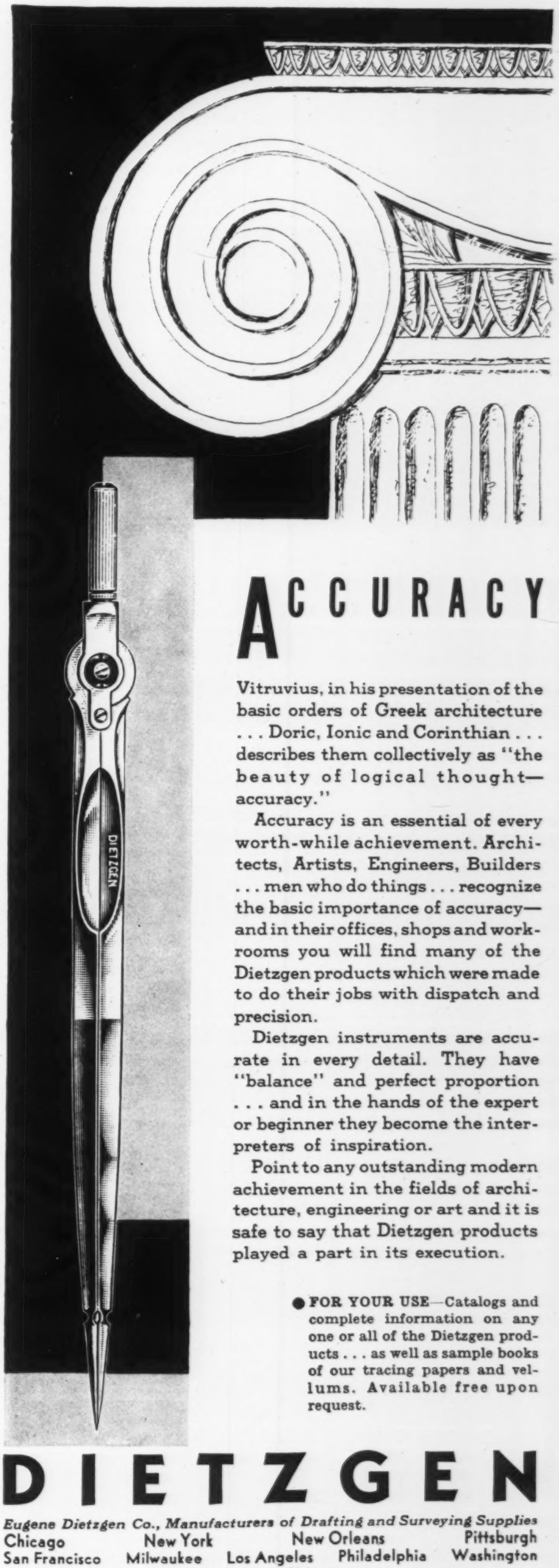
tain the resultant position of the pointer, we will assume that the planetary gears are locked during the 69/80 revolution of the arm. The pointer will therefore travel with the arm to the same position and the indicator shaft gear will make 69/80 revolution in the same direction as the arm.

The indicator shaft gear must now be rotated 69/80 revolution in the opposite direction back to its position and then 23 revolutions in this same direction due to the traverse of the carriage. It is therefore rotated 23 + 69/80 = 1909/80 revolutions. These will be transmitted through the planetary gears to the pointer, rotating the pointer 1909/ 80 × 20/30 = 15-109/120 revolutions in the same direction as the arm and its resultant position is shown in the bottom view of *Fig.* 4. At this point the traverse is disengaged. The indicator arm will continue to rotate with the spindle and the pointer will rotate in the same direction gaining ½ revolution during every ¾ revolution of the arm.

Pointer and Arm Register

During the traverse, the spindle made more than one revolution. When this one revolution was completed the arm was at *A* in *Fig.* 4, below, ¾ of a revolution from *C*. The arm will be at *D* when the next spindle revolution is completed, and if the return movement of the carriage had been the same as the forward movement, the pointer and arm would register at this position. But, as the carriage was returned 2/3 of the pitch further than the starting position, only 1/3 of a spindle revolution is required for the spindle and carriage to be in the proper positions to catch the thread. As 1/3 of a spindle revolution is equivalent to ¼ revolution of the indicator arm, the arm and pointer should register at position *C, Fig.* 4. The arm will move 11/80 revolution to reach this position, and the pointer must move 11/120 revolution in addition to the 11/80 revolution of the arm to register. As the additional movement of the pointer is equal to the movement of the arm times the ratio of 20 to the number of teeth in the change gear, we have 11/80 × 20/30 = 11/120.

The indicating mechanisms is designed so that it can be lifted out of mesh with the worm teeth on shafts *CD* and *CB,* thereby saving the mechanism from wear during regular feeding operations.



ACCURACY

Vitruvius, in his presentation of the basic orders of Greek architecture . . . Doric, Ionic and Corinthian . . . describes them collectively as "the beauty of logical thought—accuracy."

Accuracy is an essential of every worth-while achievement. Architects, Artists, Engineers, Builders . . . men who do things . . . recognize the basic importance of accuracy—and in their offices, shops and workrooms you will find many of the Dietzgen products which were made to do their jobs with dispatch and precision.

Dietzgen instruments are accurate in every detail. They have "balance" and perfect proportion . . . and in the hands of the expert or beginner they become the interpreters of inspiration.

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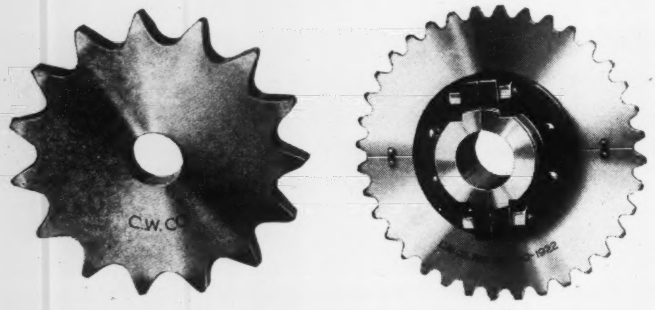
CULLMAN SPROCKETS
HAVE A RECORD OF SERVICE

One manufacturer says "We have investigated many sources for sprockets but we are still using Cullmans' . . . the best recommendation we can give you".

Cullman sprockets have a long and satisfactory record of service with many manufacturers.

Send for the Cullman Sprocket Book. It is full of information for sprocket users.



CULLMAN WHEEL CO.
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PUMPS FOR ALL PURPOSES

Experience Counts in our Business . . . Just As It Does In Yours

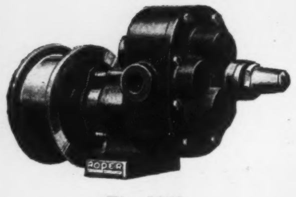


Fig. 1850

● For 77 years we have designed and built pumps . . . good pumps that have earned their spurs. There is no risk, no gamble . . . when you buy Roper Pumps . . . they are time-tested . . . and thousands of users endorse them as the best the market affords. Put your pumping problems up to Roper.

● The pump illustrated is a Roper Coolant Pump . . . The Heart of the Machine Tool.

Write for Bulletin No. R4MD.

Dependable Pumps Since 1857

GEO. D. ROPER CORP., ROCKFORD, ILLINOIS

THE HEART OF POWER
ROPER PUMPS

MEN OF MACHINES

(Concluded from Page 50)

society for 1934-1935. Vice presidents are L. A. S. Wood, Westinghouse Electric & Mfg. Co., and G. Bertram Regar, Philadelphia Electric Co.

* * *

William R. Huey, an expert on materials of construction for the DuPont company, has become associated with Continental-Diamond Fibre Co.

* * *

Lawrence M. Debing, research engineer with Bakelite Corp. and later the holder of that company's fellowship at Columbia, now is with Resinox Corp.

* * *

Harry L. Strube has been appointed assistant chief engineer of the Philadelphia plants of the Link-Belt Co. He has been succeeded as manager of the vibrating screen department by J. J. Richards, who entered the employ of the company in 1916 as a draftsman.

* * *

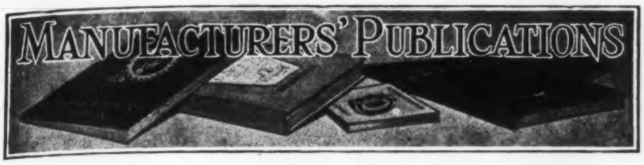
R. A. Weinhardt has been appointed assistant chief engineer of both passenger car and truck divisions of Reo Motor Car Co. He entered the auto field as chief engineer of the Nevada Motor Car Co. In 1924 he joined the Packard engineering staff and while there designed the series of engines used in recent years in Gar Wood's "Miss America" hydroplanes.

Obituaries

William C. Bolgiano, chief engineer of design of Industrial Brownhoist Corp., Bay City, Mich., died recently. He designed much of the iron ore and coal handling machinery now in use on the Great Lakes and was designer of the coal unloading machinery at Hampton Roads, Va. A native of Delaware, he came to Cleveland after engaging in engineering work in the East. At the time of his death he had been affiliated with the company for twenty-five years.

* * *

James P. Rowe, inventor of a puddling process by machine, died last month at the age of 74 years. He was a native of Wales. About twenty years ago while employed by the Pottstown Iron Co., he began work on the invention of his puddling machine. In 1922 he went to the Reading Iron Co. where he was encouraged to improve his design, with the result that the unit he patented has been operating for the past two months at the Reading plant. His puddler is the answer to the oldtime hand-puddler's taunt that "no machine can puddle iron."



MANUFACTURERS' PUBLICATIONS

ALLOYS (STEEL)—High tensile steels for lightweight construction are covered in a recent bulletin of American Sheet & Tin Plate Co., Pittsburgh. Included in the bulletin is Cor-ten steel, a low chromium copper silicon steel with a high resistance to atmospheric corrosion.

BEARINGS—Permite leaded phosphor bronze bars are presented in a recent folder of Aluminum Industries Inc., Cincinnati, which discusses these new bars, available in standard 6-foot lengths, gives their production advantages and indicates the alloys available.

COUPLINGS—Ajax Flexible Coupling Co., Westfield, N. Y., has prepared a comprehensive engineering booklet on its line of flexible couplings. Cross sectional drawings, specifications and information on the regular couplings in the line are given as well as similar data on a number of special couplings.

DRIVES—Motorized speed reducers in sizes from 1/5 to 7½ horsepower and in a wide range of ratios to fit practically any requirement of machine design or application are described in bulletin 22-1 of Janette Mfg. Co., Chicago.

DRIVES—U. S. Electrical Mfg. Co., Los Angeles, has prepared an attractive new bulletin on its line of Syncrogear motors which can be designed to produce any speed from 2 to 10,000 revolutions per minute.

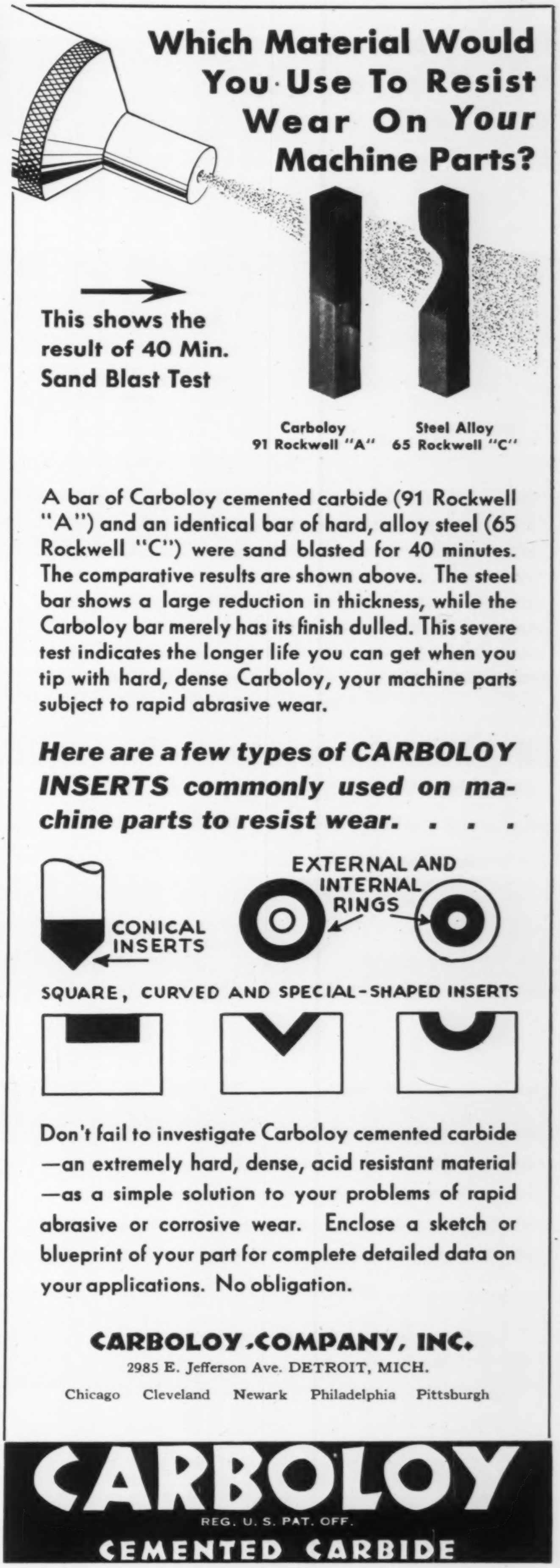
DRIVES—Motorized speed reducers as manufactured by Falk Corp., Milwaukee, are completely presented in bulletin No. 272 of the company. Included in the bulletin is complete information on the two-speed motoreducer and a revised table of service factors.

DRIVES—Louis Allis Co., Milwaukee, has published a bulletin on the dynamatic drive, a unit for use in conversion of variable speeds produced by the gasoline engine of a motor vehicle to the correct speed for operating auxiliary machinery on a moving automobile or truck.

DRIVES—A new V-belt catalog for both multiple-groove and fractional horsepower drives has been issued by L. H. Gilmer Co., Tacony, Philadelphia. The publication, JS-215, includes engineering information and comprehensive tables that will enable an engineer to specify V-belt drives completely.

DRIVES—Heliocentric and geared speed reducers in a complete line including a full range of motorized reducers are presented in a new booklet of Universal Gear Corp., Indianapolis. The booklet illustrates and describes the standard and special units in the line, includes photographs of disassembled units and of applications, gives the action of the elements, and presents engineering data, needed in the selection of the units.

GEARS—Philadelphia Gear Works, Philadelphia, has prepared a most complete catalog giving data and dimensions



Which Material Would You Use To Resist Wear On *Your* Machine Parts?

This shows the result of 40 Min. Sand Blast Test

Carboloy
91 Rockwell "A"

Steel Alloy
65 Rockwell "C"

A bar of Carboloy cemented carbide (91 Rockwell "A") and an identical bar of hard, alloy steel (65 Rockwell "C") were sand blasted for 40 minutes. The comparative results are shown above. The steel bar shows a large reduction in thickness, while the Carboloy bar merely has its finish dulled. This severe test indicates the longer life you can get when you tip with hard, dense Carboloy, your machine parts subject to rapid abrasive wear.

Here are a few types of CARBOLOY INSERTS commonly used on machine parts to resist wear. . . .

CONICAL INSERTS

EXTERNAL AND INTERNAL RINGS

SQUARE, CURVED AND SPECIAL-SHAPED INSERTS

Don't fail to investigate Carboloy cemented carbide—an extremely hard, dense, acid resistant material—as a simple solution to your problems of rapid abrasive or corrosive wear. Enclose a sketch or blueprint of your part for complete detailed data on your applications. No obligation.

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Chicago Cleveland Newark Philadelphia Pittsburgh

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CEMENTED CARBIDE

Janette

Motorized Speed Reducers —a Janette for Every Job

In a large variety of types, in single and double reduction, 1/50 to 5 horse power, and a wide range of ratios for adapting to practically any machine.

Entire unit is built and guaranteed by Janette. Made in worm gear, spur gear, planetary, worm and spur combinations. Available with split phase, capacitor, repulsion induction, repulsion, slip-ring, multispeed and constant speed, A. C. and D. C. motors. Send for Bulletin 22-1.

We Specialize in Motorized Reducers for Special Applications

Our engineering staff is at your service. With large stocks and offices in all principal cities, we can assure you of prompt attention to your requirements.

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The biggest improvement in drafting machines in 25 years! That is what draftsmen are saying about the Bruning-Wallace Drafter. A high-quality precision instrument, it eliminates use of triangle, T-square, scales and protractor. Saves 25% to 40% of drafting time. Glides smoothly and easily over the drafting board—protractor head revolves in *full circle,* making every part of board accessible.

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LOS ANGELES SAN FRANCISCO ST. LOUIS MILWAUKEE

on its line of standard spur, bevel, miter, herringbone, worm, helical and other types of gears, cut or cast in brass, iron, steel and nonmetallic materials. Included also are data on racks, universal joints, couplings, sprockets, chains and speed reducing units. Horsepower capacities and data to aid selection are given.

HEATING UNITS—Electric immersion units for heating oil are presented in a recent catalog insert of Harold E. Trent Co., Philadelphia.

LUBRICATION AND LUBRICATING EQUIPMENT—The Farval method of lubricating steel plant machinery is presented in a recent booklet of Farval Corp., Cleveland. Correct methods of lubricating heavy equipment are fully explained, both in pictures and in text. A comprehensive flow sheet shows the vital points of lubrication in all principal machines used in steel production.

MOTORS—Louis Allis Co., Milwaukee, has issued a bulletin describing the advantages and economics of shaftless motors for driving production machinery. The bulletin describes and illustrates the various types of shaftless motors, their construction and electrical characteristics. Tables and other engineering data are included.

MOTORS—Bodine Electric Co., Chicago, has prepared a bulletin on its line of electric governor-controlled motors, single phase and direct current, both with and without integral speed reducers. In addition to a complete presentation of these motors, the bulletin gives information needed for correct application and engineering data.

MOTORS—Harnischfeger Corp., Milwaukee, manufacturer of motors, arc welders, hoists, cranes, excavators and brewery equipment has prepared a most attractive gold and purple book entitled "The Fiftieth Year." The 84-page book discusses the machines of the company, introduces the personnel and discusses the company's historic beginning.

PACKING GLANDS AND PACKING—An analysis of hydraulic packings including engineering data and cross sectional views of applications is included in a recent folder of Chicago Belting Co., Chicago.

PUMPS—Worthington Pump & Machinery Corp. has published several bulletins on equipment for the petroleum industry including piston pumps and duplex piston pumps of two types, and single, two and four-stage centrifugal pumps in number of different types.

SPRINGS—Wallace Barnes Co., Bristol, Conn., has published a useful design chart on torsion springs which enables designers to make a theoretical determination of the various factors that enter into the computation of these springs. The chart is included as the center spread in the September issue of *The Mainspring.*

VALVES—Compact relief valves for industrial use are presented in a folder of Tuthill Pump Co., Chicago, which gives features and advantages of the valves and dimensions.

WELDED PARTS AND EQUIPMENT—Oxyacetylene welding and cutting pressure regulators and regulation problems are treated comprehensively in a recent booklet of Air Reduction Sales Co., New York.

WELDED PARTS AND EQUIPMENT—Oxyacetylene cutting as a production tool is comprehensively covered in an article entitled "Metallurgical Cutting" in the September issue of *Oxy-Acetylene Tips*, published by Linde Air Products Co., New York. The article goes thoroughly into the subject, giving the background, what has been done, and the possible advancements. Another article in this issue is concerned with the solution of the problem of designing a valve, making use of the cutting torch.

WIRE (ELECTRICAL)—Belden Mfg. Co., Chicago, has prepared a booklet on its new wire, intended for use on magnets, which is wrapped with cellophane.

Research Publications

The Selection and Replacement of Manufacturing Equipment, by Paul T. Norton. It is evident that economic studies of this sort can be of real use to our industries only if they are basically sound and also are expressed in such a way that they can be used by industrial executives who have not made an exhaustive study of fundamental theories. It is believed by the author that the method outlined in this bulletin is economically sound in that it includes in a satisfactory manner all of the factors which materially affect the problem; also that the method is simple enough so that it can be used safely by any competent industrial manager. Published by Virginia Polytechnic Institute, Blacksburg, Va. 35 pp.

Control Methods for Domestic Conversion Gas Burners, by L. C. Price. The object of this investigation was to determine which of the possible control methods is most economical, how much saving can be effected by the most economical method over the others, and what is the most practical method for burners of domestic size. Conversion burners are usually fitted with automatic controls of the intermittent type which usually operate the gas valve and air damper together. Sometimes, however, an installation is found in which the air damper is either absent or does not close with the gas valve. When no automatic device is used, control is generally by hand throttling of the gas only. Results of the research project are published as bulletin No. 12 of Engineering Experiment Station, University of Arkansas, Fayetteville, Ark. 18 pp.

Lubricating Oil Tests, by James I. Clower. A practical interpretation of these tests and a complete analysis of the tests and their results are presented in this bulletin. There is a general impression that conventional lubricating oil tests give a more or less complete measure of lubricating value, and that the suitability of an oil for a specific purpose may be determined by laboratory tests. Engineering materials in general are adequately specified and there is slight if any doubt as regards their suitability for specified purposes; their physical and chemical properties, safety factors and limitations are well defined. With lubricating oils, however, conditions are different. It is true their chemical and physical properties may be determined with a reasonable degree of accuracy, but what do these properties mean? What are their safety factors? What are their limitations, and for what purpose are they suitable? This bulletin explains the significance of some of the more common, standard tests, especially as to their value to the consumer. Published by Virginia Polytechnic Institute, Blacksburg, Va. 41 pp.

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7021

For High Pressures and Temperatures

GARLOCK 7021 Compressed Asbestos Sheet Packing is particularly recommended for pipe lines and equipment handling gasoline, oil, gas or steam at high temperatures and pressures.

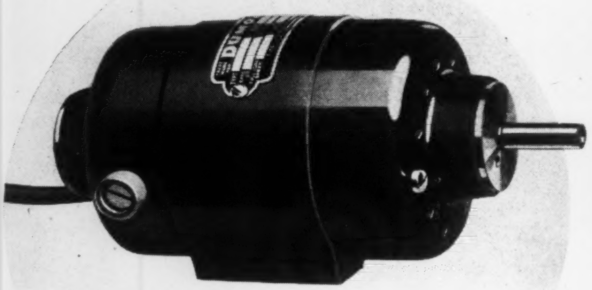
Gaskets cut from GARLOCK 7021 are saving power and lowering costs in thousands of plants every day—specially where the jobs are tough . . . where the service is severe.

Why not let GARLOCK 7021 help you cut costs in your plant, too? The saving in your cost of gasket renewals will surprise you!

THE GARLOCK PACKING COMPANY
Palmyra, New York
In Canada: The Garlock Packing Company of Canada, Ltd., Montreal, Que.

GARLOCK
Quality Controlled
PACKINGS

Note the Features of this New K-3R Dumore Motor



Designed especially for applications where better-than-average performance is required, this new K-3R Motor has many features to command your interest—They are: Aluminum housing, ball bearings, 3/8 inch diameter shaft extension, high speed winding, efficient cooling system and dynamically balanced armature—Speed and power can be changed to suit specific application. Write for complete details.

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Sixteenth Street, Racine, Wis.

DUMORE
FRACTIONAL HORSEPOWER
MOTORS

COMPANY WANTS NEW DEVICES TO MANUFACTURE and MARKET

A company with ample capital, efficient factory and aggressive selling organization wants new and original devices to manufacture and market.

They specialize in the manufacture of light complicated machines made of metal and weighing under 100 pounds.

This company will be very glad to hear from any person having a device, machine or invention that they are not able to promote themselves.

Address your communication to

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1213 W. 3rd St., Cleveland, O.

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MACHINE DESIGN is a monthly technical publication conceived, edited and directed expressly for those executives and engineers responsible for the creation and improvement of machines built for sale, and for the selection of the materials and parts to be used.

BUSINESS ANNOUNCEMENTS AND SALES BRIEFS

R. X. RAYMOND has been appointed manager of the Minneapolis district for Chain Belt Co., Milwaukee, succeeding G. A. Gunther, who has been transferred to become district manager of the company's Detroit office. The Minneapolis office is located at 808 La Salle avenue, and the Detroit office is located at 5169 Martin street.

* * *

J. S. Mohr has been appointed manager of sales of Hubbard Steel Foundry division, Continental Roll & Steel Foundry Co., East Chicago, Ind.

* * *

L. S. Stephens has been elected president of Stephens-Adamson Mfg. Co., Aurora, Ill., manufacturer of conveyors, to succeed D. B. Piersen.

* * *

Walter J. Bothwell has been appointed district sales manager of the Detroit district for Jones & Laughlin Steel Corp., Pittsburgh.

* * *

H. S. McPherson has been appointed manager of mechanical sales in the St. Louis district for United States Rubber Products Inc., New York.

* * *

Revere Copper & Brass Inc., New York, has opened an office at 922-23 Grand Rapids National Bank building, Grand Rapids, Mich. David T. Applebee is the district manager.

* * *

Sier-Bath Co., 640 West Fifty-eighth street, New York, maker of precision gears, has received a contract from S-B Gear Corp. to manufacture the latter company's complete line of speed reducers.

* * *

Stanley Allen Hunt has been placed in charge of sales for Alan Wood Steel Co., Conshohocken, Pa., in the South and Southwestern districts. He will have offices in Houston, Tex.

* * *

Acheson Colloids Corp., Port Huron, Mich., has removed its New York office to 444 Madison avenue. The business of this office is devoted entirely to field research work, patents and trade marks, finances and legal matters.

* * *

Russell M. Allen, formerly district sales manager at Chicago for Allegheny Steel Co., Brackenridge, Pa., has been promoted to the position of assistant general manager of sales with headquarters at the main offices of the company in Brackenridge.

* * *

Steel & Tubes Inc., Cleveland, has recently undertaken to establish distributors of electrically welded mechanical tubing in the important tubing centers in the United States. The first warehouse stock of mechanical tubing established by the company was that of Tubular Service Corp. of New York, Philadelphia and Boston. Subsequently, stocks have been put in by Service Steel Co., Detroit; Williams & Co., Pittsburgh; Hamilton Steel Co., Cleveland, and Edgar T. Ward's Sons Co., Chicago.

* * *

Marlin-Rockwell Corp., Jamestown, N. Y., manufacturer of ball bearings, has opened a factory branch at 550 Polk street, San Francisco. James Ross Brown has been appointed manager of this branch.

* * *

Wyckoff Drawn Steel Co. has removed its general offices from Ambridge, Pa., to suite 1308, First National Bank building, Pittsburgh.

* * *

Merritt C. Wemple, formerly sales engineer in the Rockford office of Geo. D. Roper Corp., Rockford, Ill., manufacturer of pumps, has opened a branch sales office of the company in Cleveland, at 320 Rockefeller building.

* * *

Samuel R. Hoover, veteran sales executive of Carnegie Steel Co., Pittsburgh, has recently retired from active business. Until recently when he was assigned to special sales duties, he had been assistant general manager for sales for the company.

* * *

Charles L. Hyland, for years in the sales organization of Empire Steel Corp. and Empire Sheet & Tin Plate Co., with offices in Dayton, O., has been named manager of sales for Empire Sheet & Tin Plate, with headquarters in Mansfield, O.

* * *

Ernest A. Earle, for eight years chief engineer for Arrowhead Steel Products Co., Minneapolis, and for four years afterward associated with the Buffalo plant of the company, has been appointed sales representative in Pennsylvania, New York and the New England states for the industrial division, Aluminum Industries Inc., Cincinnati. Mr. Earle's headquarters will be in Buffalo.

* * *

A reorganization of Gears & Forgings Inc., Cleveland, has been effected under the name of Ohio Forge & Machine Corp. The new company will operate the former Ohio Forge and Van Dorn Dutton divisions of Gears & Forgings. Officials of the new company include F. H. Chapin, president of National Acme Co., chairman of the board; S. C. Dalbey, formerly of Ohio Forge Co., president; and R. B. Tripp, formerly general sales manager of Gears & Forgings, general sales manager. The company will manufacture all types of gearing, power transmission equipment and a full line of speed reducers.